Course Title: Quantitative, Population, Ecological and Human Genetics & Animal Breeding		
Course Code: Zool.M.632	**Course Type:** Theory (Core Course, Mandatory)	**Credits:** 4
Full Marks: 100	**Total Lecture hours:** 60	**Exam Hours:** 4

Course Description

The course has been designed to expertise the MS students with the understanding of quantitative, population, ecological and human genetics along with various aspects of animal breeding. It will provide detailed descriptions of polygenic inheritance, biological variations, effects of limiting factors on allelic frequencies in populations, tools for estimating genetic variability; effects of polymorphisms on animal distribution, speciation and genetic differentiation. In addition, chromosomal abnormalities and metabolic disorders in man and modern approaches to human welfare. Such important aspects of animal breeding as linkage, crossing-over and chromosome mapping, breeding types and their genetic effects on farm animals, effects of natural/artificial selection on the quantitative traits in animals and the genetic control strategies for pest insects have been incorporated. Zoology graduates would therefore benefit from this advanced course in their understanding and knowledge of genetics for its practical applications in the job market.

Course Learning Objectives

1. To provide the MS students an in-depth knowledge of the quantitative, population, ecological and human genetics with a lot of examples from man and other animals;
2. To present detailed accounts of the animal breeding including the significance of linkage and crossing-over, chromosome mapping, inbreeding, outbreeding and hybridization in farm animals and modern genetic approaches to insect pest control; and
3. To strengthen their undergraduate knowledge and understanding of the classical and molecular genetics, previously learned from the relevant B. Sc. (Hons) courses.

Course Learning Outcomes (CLOs)

After attending the lectures on **Quantitative, Population, Ecological and Human Genetics & Animal Breeding**, the Zoology graduates will be able to:

1. Define quantitative genetics, compare quantitative *vs*. qualitative traits and polygenes *vs*. major genes; characterize polygenes and inheritance of skin colour in man.
2. Estimate the number of polygenes and describe transgressive variations in man and chickens.
3. Classify biological variations into phenotypic, genetic and environmental categories, and identify the sources of origin of variations and their significance.
4. Define Hardy-Weinberg law of genetic equilibrium and its limiting factors; Calculate effects of selection on the allelic frequencies of a population.
5. Estimate the effects of mutation and migration on the allelic frequencies of a population.
6. Estimate the effects of genetic drift and meiotic drive on the allelic frequencies of a population.
7. Know about the tools for estimating genetic variability in natural populations; brief protocols for electrophoresis, PCR and their applications.
8. Understand genetic differentiation and speciation: Define, classify the types and their mechanisms.
9. Explain polymorphism, identify types and provide examples in *Drosophila* and land snails; recognize the significance of polymorphism in the adaptation and evolution of animals.
10. Classify human chromosomes and describe human disorders associated with autosomal and sex chromosomal abnormalities.
11. Describe the single-gene metabolic disorders in man along with their diagnostic features and metabolic pathways.
12. Discuss the polygenic metabolic disorders in man; their symptoms, diagnosis, risk factors and treatment options.
13. Comprehend the genetics of human haemoglobin, its types, variants, chemistry and molecular biology; and compare haemoglobin disorders or haemoglobinopathies in human populations.
14. Describe human twins and multiple births: Types, frequencies and significance in genetic studies.
15. Know about Human Genome Project (HGP), Genomics and Proteomics; their relevance to human welfare.
16. Compare eugenics, euphenics and euthenics: their sub-types, merits and demerits, and applications.

17. Prof. Dr. Rezina Laz
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Course contents, teaching-learning processes and alignment of topics with CLOs

Course contents	**Teaching-learning processes**	**Alignment of topics with CLOs**	**LH**
Quantitative Genetics			
Quantitative *vs*. qualitative traits; polygenes *vs*. major genes; characteristics of polygenes; inheritance of skin colour in man.	• Lecture • Open discussion • Exercise/Tutorial	CLO 1	2
Estimation of the number of polygenes; transgressive variations in man and chickens.	• Lecture • Group discussion	CLO 2	2
Biological variations: Phenotypic, genetic and environmental variations, sources of origin of variations and their significance.	• Lecture • Open discussion • Exercise/Tutorial	CLO 3	2
Population Genetics			
Hardy-Weinberg law and its limiting factors; Effects of selection on the allelic frequencies of a population.	• Lecture • Open discussion • Exercise/Tutorial	CLO 4	2
Mutation and migration; their effects on the allelic frequencies of a population.	• Lecture • Open discussion • Exercise	CLO 5	2
Genetic drift and meiotic drive; their effects on the allelic frequencies of a population.	• Lecture • Open discussion • One plus one cyclic recalling game	CLO 6	2
Ecological Genetics			
Tools for estimating genetic variability in natural populations: Brief protocols for electrophoresis, PCR and their applications.	• Lecture • Open discussion • One plus one cyclic recalling game	CLO 7	2
Genetic differentiation and	• Lecture		

speciation: Definition, types and mechanisms.	• Open discussion • Exercise	CLO 8	2
Polymorphism: Definition, types and examples in *Drosophila* and land snails; significance of polymorphism in the adaptation and evolution.	• Lecture • Open discussion • Exercise	CLO 9	2
Human Genetics			
Classification of human chromosomes; human disorders associated with autosomal and sex chromosomal abnormalities.	• Lecture • Open discussion • One plus one cyclic recalling game	CLO 10	2
Single-gene metabolic disorders in man: Diagnostic features and metabolic pathways.	• Lecture • Open discussion • Exercise	CLO 11	2
Polygenic metabolic disorders in man: Symptoms, diagnosis, risk factors and treatment options.	• Lecture • Open discussion • Exercise/Tutorial	CLO 12	2
Genetics of human haemoglobin: Types, variants, chemistry and molecular biology; Haemoglobin disorders or haemoglobinopathies.	• Lecture • Open discussion • One plus one cyclic recalling game	CLO 13	2
Human twins and multiple births: Types, frequencies and significance in genetic studies.	• Lecture • Open discussion • One plus one cyclic recalling game	CLO 14	2
Human Genome Project (HGP), Genomics and Proteomics; their relevance to human welfare.	• Lecture • Open discussion • Exercise/Tutorial	CLO 15	2
Eugenics, euphenics and euthenics: Comparisons, types, merits, demerits and applications.	• Lecture • Open discussion • Exercise/Tutorial	CLO 16	2
Linkage and crossing-over	**Prof. Dr. Rezina Laz**		
	• Lecture • Open discussion • Exercise	CLO 17	2
	• Lecture • Group discussion • Exercise	CLO 18	2
	• Lecture • Open discussion • One plus one cyclic recalling game	CLO 19	2
Chromosome mapping	**Prof. Dr. Rezina Laz**		
	• Lecture • Open discussion		

		CLO 20	2
	• Lecture • Group discussion • Debates	CLO 21	2
	• Lecture • Open discussion • One plus one cyclic recalling game	CLO 22	2
Animal Breeding	**Prof. Dr. Rezina Laz**		
	• Lecture • Open discussion • One plus one cyclic recalling game	CLO 23	2
	• Lecture • Open discussion • One plus one cyclic recalling game	CLO 24	2
	• Lecture • Open discussion • One plus one cyclic recalling game	CLO 25	2
	• Lecture • Open discussion • One plus one cyclic recalling game	CLO 26	2
	• Lecture • Open discussion • One plus one cyclic recalling game	CLO 27	2
	• Lecture • Open discussion • One plus one cyclic recalling game	CLO 28	2

Assessment Strategies

Types of Assessment	**Components**	**Marks**	**Methods of Assessment**
Final Written Examination	Broad Questions	35	As mentioned in the Course: Zool.M.611 (Page No.)
	Short Questions	35	
Continuous Assessment	Attendance	10	
	Tutorial	20	

Learning Resources:

Ahluwalia, K.B. : Genetics
Altenberg, E. : Genetics
Ali, S.J. : Animal Breeding (in Bangla)
Ayala, F.J & Kiger, Jr. : Modern Genetics
Burns, G.W. : The Science of Genetics
Burnett, L. : Essential Genetics
Caballero, A. : Quantitative Genetics
Darlington, C.D. & Lacour, L.F. : The Handling of Chromosomes
Dobzhansky, T. : Genetics and the Origin of Species
Dupraw, T.E.J. : DNA and Chromosome
Emery, A.E.H. & Mueller, R.F. : Elements of Medical Genetics
Falconer, D.S. : Introduction to Quantitative Genetics
Ford, E.B. : Ecological Genetics
Freifelder, D. : Molecular Biology

Gardner *et al.* : Principles of Genetics
Griffiths *et al*. : An Introduction to Genetic Analysis
Hamilton, M.B. : Population Genetics
Hartl, D.L. & Clark, A.G. : Principles of Population Genetics
Islam, A.S. : Fundamentals of Genetics
Islam, M.S. : Selected Lectures on Genetics
Jain, H.K. : Genetics: Principles, Concepts and Implications
Jenkins, J.B. : Genetics
King, R.C. : Genetics
Klung, S.W. & Cummings, R.M. : Concepts of Genetics
Lowe *et al*. : Ecological Genetics: Design, Analysis and Application
Lynch, M. & Walsh, B. : Genetics and Analysis of Quantitative Traits
Nicholl, D.S. : An Introduction to Genetic Engineering
Novitski, E. : Human Genetics
Pal, R. & Whitten, M.J. : Use of Genetics in Insect Control
Rashid, K. M. *et al.* : Textbook of Community Medicine and Public Health.
Serra, J.A. : Modern Genetics
Singh, C.V. : Animal Breeding and Genetics
Singleton, W.R. : Elementary Genetics
Sinnott, *et al*. : Principles of Genetics
Smith, J.E. : Biotechnology
Snustad, D.P. & Simmons, M.J. : Principles of Genetics
Snyder, A.L. *et al.* : General Genetics
Srb, A. & Owen, R.D. : General Genetics
Stansfield, W.D. : Theory and Problems of Genetics
Stern, C. : Principles of Human Genetics
Strickberger, M.W. : Genetics
Sutton, H.E. : An introduction to Human Genetics
Suzuki, D.T. & Griffiths, A.J.F. : An introduction to Genetic analysis
Taneri *et al*. : Human Genetics and Genomics: A Practical Guide
Thiagarajan, R. : Textbook of Animal Breeding
Verma, P.S. & Agarwala, V.K. : Genetics
Winchester, A.M. : Genetics
ইসলাম, আ.শা. : বংশগতির মূলকথা।
ইসলাম, এম.সা. ও অন্যান্য : জেনেটিক্স: মিল ও অমিলের বিজ্ঞান।
খান, হা.সা. ও ইসলাম, এম.সা. : জৈবপ্রযুক্তি ও জীন প্রকৌশল।
গুহ, সু. : জীন, বংশধারা ও বিবর্তন।
পাল, এন.কে. : বংশগতিবিদ্যা।
রহমান, মো. আ. : কোষতত্ত্ব ও বংশগতিবিদ্যা।

MSI: 15-06-2021