

<b>Semester:</b>	06		
<b>Course Code:</b>	ZOOL 42784		
<b>Course Name:</b>	Molecular Genetics		
<b>Credit Value:</b>	04		
<b>Status:</b>	Compulsory		
<b>Pre-requisite:</b>	ZOOL 41752		
<b>Co-requisites:</b>	None		
<b>Hourly Breakdown:</b>	Theory	Practical	Independent Learning
	45	45	110

**Intended Learning Outcomes:**

After completion of this course unit, the student will be able to:

1. explain the central dogma in molecular biology, genome architecture, fundamentals of genomics and gene expression regulation of prokaryotes and eukaryotes,
2. discuss recent advances and applications of molecular genetics and genomics,
3. appraise the importance of genetics and genomics in contemporary science and human health,
4. demonstrate essential skills and competencies in molecular biology, DNA cloning, expression analysis, molecular diagnostics and,
5. critically assess recent advances in genomics research and applications emphasizing scientific, ethical and socio-economic aspects.

**Course Content:**

Dynamic concept of “Gene”, Architecture and plasticity of genomes, Human genome projects: selected genome projects including ENCODE and Human Epigenome Project, Overview of the central dogma of molecular biology, Components and mechanisms of regulation in gene expression: chromatic modification, transcriptional factors and regulators, promoters, mechanism of activation, transcript processing and modification, anti-sense RNA, positive and negative regulation, attenuation, feedback inhibition and riboswitches, Mutation and repair, Post-translational modification of proteins, Non-coding genome: small and long non-coding RNA, mobile genetic elements, introns, cis-trans regulatory elements, pseudogenes and their mechanism of action, Principles of epigenetics: DNA methylation and histone modification, Components of genomics: structural, functional and comparative genomics, Horizontal gene transfer: Conjugation, transformation and transduction, Genetic modification, Genome editing technologies, Model systems in genetics, Genetic basis of selected human diseases and cancer genomics, Gene therapy, genomic medicine and pharmacogenomics, Prospects, applications, challenges, ethical, legal, and socio-economic implications of genetics, gene editing and genomic research, Current topics in molecular genetics and genomics.

Practical sessions on Gene cloning: DNA extraction, cDNA synthesis, Applications of PCR, screening of genomic libraries, selectable markers, reporter genes, construction of vectors, transformation and selection of recombinants by screening and expression signals, preparation for sequencing analysis, Applications of molecular biological and recombinant DNA technology: Techniques of gene expression analysis and molecular diagnostics, nucleic acid-based therapeutics, recombinant protein antigens and monoclonal antibodies in diagnostics and research.

**Teaching /Learning Methods:**

A combination of lectures, laboratory sessions, computer-based learning, seminars and assignments, self-studies and small group discussions.

**Assessment Strategy:**

Continuous assessment and end of semester examination. Percentage given for each sub-component indicates the percent contribution to the final marks.

Continuous Assessment 30 %	Final Assessment 70 %		
Details: Assignments 15 % Laboratory reports 15 %	Theory 50 %	Practical 20 %	Other -

**Recommended Readings:**

1. Watson, J.D., T.A. Baker, S.P. Bell, A. Gann, M. Levine, R. Losick & S.C. Harrison (2014). Molecular Biology of the Gene, 7<sup>th</sup> Edition, Pearson Education, Inc.
2. Cox, M.M., J. Doudna & M. O'Donnell (2015). Molecular Biology: Principles and Practices, 2<sup>nd</sup> Edition. W. H. Freeman.
3. Lesk, A. (2017) Introduction to Genomics, 3<sup>rd</sup> Edition, Oxford University Press.
4. Sambrook, J., F.F. Fritch, & T. Maniatis (2012). Molecular Cloning - A Laboratory Manual, 4<sup>th</sup> Edition Cold Spring Harbor Laboratory, USA.
5. Selected scholarly review and research articles on molecular genetics and genomics.