Name of the Programme: M. Sc. Zoology
Course Code: ZOO–521 **Title of the Course:** Advances in Genetics (Theory)
Number of Credits: 03
Effective from AY: 2023-24

Pre-requisites for the Course:	Basic working knowledge of classical genetics	
Course Objectives:	1. To develop concepts of genetics pertaining to human beings 2. To classify chromosomes and modes of inheritance 3. To recognize genetic abnormalities and recall their significance in medical genetics	
Content:	**Module 1** Basic principles of genetics, human genetic make-up, genes as submicroscopic factors controlling human traits, packing of DNA/chromatin into chromosomes, nucleosomes and histones. Review on test cross, back cross, Polytene and Lampbrush chromosomes, human chromosome structure, sex determination in man, sex chromatin, Lyon hypothesis, human karyotype, banding techniques, chromosome identification and nomenclature (ISCN). Principles of inheritance in man (autosomal / sex linked / dominant / recessive / mitochondrial inheritance); human pedigree analysis, human genetic disorders, chromosomal (structural and numerical; autosomal or X linked) and biochemical (congenital diseases / inborn errors of metabolism) with examples, Eugenics, euphenics and euthenics; genetic counseling.	15 hours
	Module 2 Prenatal diagnosis of genetic disorders, cytogenetic, biochemical and ultrasonography techniques, amniocentesis, chorionic villus sampling, cordocentesis**,** biochemical markers for prenatal diagnosis, triple test for Down's syndrome. Dermatoglyphics and its application in the diagnosis of human genetic disorders**,** principles of FISH, RFLP & DNA fingerprinting and their uses in human genetics. Genetic models: mouse as a model mammal for genetic studies, other animal models for human diseases.	15 hours 15 hours
	Module 3	

	Cancer genetics: Introduction and cellular aspects; types of cancers, protooncogenes; oncogenes; viruses and cancer; oncoproteins; tumor suppressor genes; inherited cancer genes (familial cancers); cell cycle dysregulation in cancer, chromosomal instability; roles of p21, p53, ATM, BRCA1/2 in preventing cancer, tests for detection of cancer, treatment of cancer: radiotherapy, chemotherapy, hyperthermia, targeted drug therapy, immunotherapy Mapping genomes: a) Genetic mapping – DNA markers - RFLPs, SSLPs, SNPs b) Physical mapping - Restriction mapping, fluorescence in situ hybridization (FISH), radiation hybrid mapping and sequence tagged site mapping, gene mapping in Drosophila using two point and three point test crosses with an emphasis on interference and coefficient of coincidence.	
Pedagogy:	Lectures/ tutorials/online teaching mode/self-study and discussions/ Assignments/ Group activities/ Presentations	
References/ Readings:	1. P. Turnpenny, S. Ellard, Emery's Elements of Medical Genetics and Genomics, 16th ed. Elsevier, 2020. 2. T. Strachan, A. Read, Human Molecular Genetics, 5th edition. Garland Science, 2018. 3. M.L. Kothari, L.A. Mehta, and S.S. Roychoudhury, Essentials of Human Genetics, India: Oxford University Press, 2009. 4. B.A. Pierce, Genetics: A Conceptual Approach, 7th ed. W. H. Freeman and Company, 2020. 5. B. Alberts, A. Johnson, J. Lewis, M. Raff, K. Roberts, and P. Walter, Molecular Biology of the Cell, 6th ed. New York, USA: Taylor & Francis Group, 2014.	
Course Outcomes:	The learner will 1. Identify the different modes of inheritance of genetic disorders 2. Categorize the different types of genetic disorders 3. Determine the medical significance of genetic alterations 4. Interpret the results of various techniques for diagnosis of genetic diseases	

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