Department of Liberal Education
Era University, Lucknow
Course Outline
Effective From: 2023-24

Name of the Program	**B.A. / B.Sc. (LIBERAL EDUCATION)**			**Year/ Semester:**	**2nd Year/4th Semester**
Course Name	Genetics and Gene Expression (C)	**Course Code:**	**BCH301**	**Type:**	**Theory**
Credits	**03**			**Total Sessions Hours:**	**45 Hours**
Evaluation Spread	**Internal Continuous Assessment:**	**40 Marks**		**End Term Exam:**	**35 Marks**
Type of Course	○ Compulsory	◉ Core		○ Creative	○ Life Skill
Course Objectives	Throughout the course, students will be expected to learn the basics of genes, its function and mechanism of expression of genes in relation to human biology. The objective of this course is to provide conceptual understanding of various genetic combinations, in particular, with value to science, medicine, agriculture, and industry.				

Course Outcomes(CO): *After the successful course completion, learners will develop following attributes:*

Course Outcome (CO)	**Attributes**
CO1	The concept of genes and its components will be understood by the students.
CO2	The students will be able to delineate the pathway of gene expression
CO3	The students can correlate the genetic makeup with phenotypic characters, mutations and understand their relation in well being
CO4	The students would get to know about various techniques to study genetics and its applications
Pedagogy	Interactive, discussion-bases, student-centered, presentation.
Internal Evaluation Mode	Mid-term Examination: 20 Marks Class test: 05 Marks Online Test/Objective Test: 05 Marks Assignments/Presentation: 05 Marks Attendance: 05 Marks

Session Details	**Topic**	**Hours**	**Mapped CO**
Unit 1	**Introduction to genetics**: • Mendel's laws of heredity: Test cross, back cross, incomplete dominance, co-dominance, Allele, Pseudo allele, Non allelic Mechanism and importance of Recombination, Linkage and Crossing over, Linkage map • Extra-chromosomal inheritance: Mitochondrial and chloroplast inheritance • Concept of epigenetics	11	CO1

	• Population genetics: Allele frequency, Haplotype, Genotype frequency, polymorphism, Genetic Drift & Hardy Weinberg Law equilibrium and its application.		
Unit 2	**Organization of Genetic Material**: • In Prokaryote and Eukaryotes • Unique and repetitive DNA, interrupted genes and gene families. • Split genes, overlapping genes; pseudogenes, cryptic genes, insertion elements and transposons. **Chromosomal organization**: Centromere, telomere, euchromatin and heterochromatin, Nucleosome model, Polytene and Lampbrush chromosomes **DNA Replication**: • Prokaryotic and Eukaryotic – Enzymes and proteins involved in replication • Theta model • Rolling circle model • Linear mode of DNA replication.	12	CO1, CO2
Unit 3	**Gene Expression:** concept and stages of gene expression **Transcription:** • Mechanism, Promoters and RNA polymerase, transcription factors in prokaryotes and eukaryotes • Post-transcriptional modifications of eukaryotic mRNA. **Translation**: • Mechanism of translation in Prokaryotes and Eukaryotes • Post-translational modifications of proteins **Regulation of Gene expression in Prokaryotes**: • Operon concept (Lac and trp); • Regulation of Gene expression in Eukaryotes: transcriptional activation, • Galactose metabolism in yeast. **DNA damage and Repair**: • Exogenous and endogenous damage to DNA; • DNA repair mechanism by photoreactivation, nucleotide and base excision repairs, mismatch repair, SOS repair.	12	CO3
Unit 4	**Structure and numerical aberrations of chromosomes**: • Deletion, duplication, inversion, translocation, • Aneuploidy and Euploidy and their genetic consequences- Kleinefelter, Turner, Cri-du-chat and Down syndromes. **Genetic code and Mutations**: • Properties and Wobble hypothesis. • Spontaneous and induced mutations, • Single nucleotide polymorphism (SNP), Frame-shift mutation, Base substitution mutation • Synonymous and Non-synonymous substitution mutations; • Mutation based on function- Loss-of-Function and Gain-of-Function mutations **Human genetics**: • Karyotype	10	CO3, CO4

	• Various human genetic disorders-sickle cell anemia, color blindness, thalassemia and hemophilia. **Genetic Testing Techniques & its application**		

CO-PO and PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	3	2	2	3	3	2	2	1	3	2	2	1	2	1
CO2	3	3	2	2	2	2	2	1	3	2	2	2	2	2
CO3	3	2	2	3	2	2	2	1	3	2	3	2	2	2
CO4	3	2	2	2	3	2	2	1	3	2	2	2	2	2

Strong contribution-3, ***Average contribution-2,*** ***Low contribution-1***

Suggested Readings:

Text-Books	1. Principles of Genetics, Gardner, M. J. Simmons, D. P. Snustad · Wiley Student Edition. 8th Edition. 2. Human Genetics for Medical and Life Sciences, Bheem Prasad. Current Books International Publishers. Latest Edition.
Reference Books	1. Genetics: A Conceptual Approach. Pierce, B.A McMillan Publishers, Latest Edition 2. Human Genetics. SD Gangane. Elsevier Publications. 6th Edition 3. Lippincott Illustrated Reviews_ Biochemistry, DR Ferrier. Latest Edition
Para Text	• https://www.genome.gov/ • https://www.sanfoundry.com/best-reference-books-bsc-genetics/ • RNA interference (RNAi) Animation || miRNA || siRNA || mRNA regulation: https://youtu.be/_Bl_l9SNvjA • Genome Editing with CRISPR-Cas9: https://youtu.be/2pp17E4E-O8 • CRISPR-Cas9 Genome Editing Technology: https://youtu.be/IiPL5HgPehs

Recapitulation & Examination Pattern

Component	Marks	Pattern
Mid Semester	20	**Section A:** Contains **10** MCQs/Fill in the blanks/One Word Answer/ True-False type of questions. Each question carries **0.5Marks.** **Section B:** Contains **07** descriptive questions out of which **05** questions are to be attempted. Each question carries **03 Marks**.
Class Test	05	Contains **05 descriptive questions.** Each question carries **01** Mark.
Online Test/ Objective Test	05	Contains **10 multiple choice questions.** Each question carries **0.5**Marks.
Assignment/ Presentation	05	Assignment to be made on topics and instruction given by subject teacher.
Attendance	05	As per policy.
Total Marks	**40**	

Course created by: Dr. Ghazala Zaidi **Signature:**	**Approved by: Prof. Sudhir Mehrotra** **Signature:**