UNIVERSITY OF MADRAS

B.Sc. DEGREE PROGRAMME IN ADVANCED ZOOLOGY AND BIOTECHNOLOGY

SYLLABUS WITH EFFECT FROM 2023-2024

SEMESTER - IV

Course Code	Course Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	External	Total
221C4A	**GENETICS AND EVOLUTION**	Core	Y	-	-	-	5	5	25	75	100

Learning Objectives	
CO1	To understand inheritance patterns and understand the principles of heredity, modification and extensions of Mendel's basic principles and role of genetics in biology.
CO2	To know the causes and effects of genetic variation and to gain Knowledge in linkage & recombination (crossing over) and chromosomal mutations
CO3	To Understand 'DNA' as the basic genetic material and regulation of gene expression.
CO4	To Interpret that process of evolution depends on genetic variation and know the major events in the evolution..
CO5	To perceive the micro evolutionary concepts and principle of macroevolution.

UNIT	Details	No. of Hours	Course Objectives
I	**Mendel and his experiments** (Monohybrid and dihybrid cross)-Laws of inheritance- Mendelian traits in Man-Complete, incomplete and codominance- Gene interaction- epistasis- Lethal and multiple alleles-Polygenes and polygenic inheritance-Sex determination-genic balance theory, chromosomal mechanism of sex determination- Sex-linked characters- sex limited genes-Cytoplasmic inheritance- CO_2 sensitivity in drosophila, Kappa particles in paramecium- Genetic maternal effect in shell coiling of *Limnaea*	15	CO1, CO2
II	**Linkage**- Morgan's experiment, complete & incomplete linkage- **Crossing over**- types, mechanisms- chromosome mapping- interference and coincidence- Non-disjunction & translocation of chromosomes- Chromosomal Aberrations-Structural & Numerical- Mutations- Types, mutagens, and molecular basis of mutation.	15	CO1, CO2, CO4, CO5

III	**DNA as the genetic material-**Griffith Effect- DNA replication and repair mechanism- Fine structure of gene- Regulation of gene expression- operon concept (*Lac* operon)- Inborn errors of metabolism- Phenyl alanine metabolism, Genetic counselling- Eugenics & Euthenics	15	CO1, CO2, CO3, CO4, CO5
IV	**Origin of life**: Synthesis of organic molecules, Urey-Miller experiment**Theories of Evolution**- Lamarckism, Neo Lamarckism, Darwinism, Neo-Darwinism, Modern synthetic-Morphological, physiological, biochemical, embryological and palaeontological evidences- Geological time scale-Fossil & Fossilisation- Types, Living and Extinct fossils.	15	CO1, CO2, CO4, CO5
V	**Speciation and isolating mechanism** -Isolating mechanisms - Modes of speciation ,Genetic drift-Adaptive radiation-HardyWeinberg equilbrium- Convergent, Divergent and Parallel evolution- Coevolution- Evolution of Horse and Humans (Biological & Cultural).	15	CO1, CO2, CO4, CO5
	Total	**75**	

Course Outcomes		
Course Outcomes	On completion of this course, students will;	
CO1	Understand the basis of inheritance and expression of genes.	PO1
CO2	Correlate changes in genetic makeup and phenotypic changes in progeny.	PO1, PO3, PO5
CO3	Analyse the causes of variations in genetic material and predict the effect in a population using different techniques and understand 'DNA' as the basic genetic material and regulation of gene expression.	PO1, PO3, PO4, PO5, P06
CO4	Interpret that process of evolution depends on genetic variation and know the major events in the evolution..	PO1,PO4,PO5
CO5	Compile the factors which contribute to changes in gene expression and specify the changes which contribute to evolution and perceive the micro evolutionary concepts and principle of macroevolution.	PO1, PO3, PO4, PO5, PO6, PO8

Text Books (Latest Editions)	
1.	John C.Herron and Scott Freeman (2015). Evolutionary analysis. V Edition. Pearson Education

2.	Guptha G. K., 2013. Genetics Classical to Modern, Rastogi publishers, Meerut.
3.	Lewin B., 2008. Genes IX, Jones and Bartlett publishers.
4.	Veer Bala Rastogi., 2019. Text Book of Genetics, Medtech
5.	Verma P.S and Agarwal V.K., 2006. Cell Biology, Genetics, Molecular Biology, Evolution and Ecology, S. Chand & Company Ltd.
6.	Verma P. S. and V. K. Agarwal., 2018. Genetics, S. Chand & Company Pvt Ltd.
References Books (Latest editions, and the style as given below must be strictly adhered to)	
1.	Cooper, Geoffrey M., 2018. The cell: A Molecular Approach, Eighth Edition, Oxford University Press.
2.	Dadson E.O. (1960). Evolution: Process and Product. Reinhold Pub.
3.	Dobzhansky T., 1982. Genetics and The Origin of Species, Columbia University.
4.	Fletcher H and Hickey I., 2015. Genetics, IV Edition. GS, Taylor and Francis Group, New York and London.
5.	Gardner, Anne. 2009. Human Genetics, Scion Publishing Ltd.
6.	Klug, W. S., Cummings, M. R., Spencer, C. A., 2012. Concepts of Genetics. X Edition. Benjamin Cummings.
7.	Lodish, Harvey, Arnold Berk *et al* .,2007. Molecular cell biology. 6th edition, W. H. Freeman.
8.	Russel, Peter J. 2013. iGenetics: A Molecular Approach, Pearson.
9.	Strickberger M. W., 1995. Genetics, Prentice Hall India Learning Private Limited.
Web Resources	
1.	https://go.nature.com/2XE8V1q
2.	https://bit.ly/3zoTt6B
3.	https://bit.ly/2XAm7oa
4.	https://bit.ly/2XEbhxi
5.	https://bit.ly/3AB4bso
6.	https://bit.ly/39pZSE4
7.	https://www.genome.gov/genetics-glossary/Sex-Linked
8.	https://www.vedantu.com/biology/mutagens

Methods of Evaluation

Internal Evaluation	Continuous Internal Assessment Test	25 Marks
	Assignments	
	Seminars	
	Attendance and Class Participation	
External Evaluation	End Semester Examination	75 Marks
	Total	100 Marks

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Methods of Assessment	
Recall (K1)	Simple definitions, MCQ, Recall steps, Concept definitions
Understand/ Comprehend (K2)	MCQ, True/False, Short essays, Concept explanations, Short summary or overview
Application (K3)	Suggest idea/concept with examples, Suggest formulae, Solve problems, Observe, Explain
Analyze (K4)	Problem-solving questions, Finish a procedure in many steps, Differentiate between various ideas, Map knowledge
Evaluate (K5)	Longer essay/ Evaluation essay, Critique or justify with pros and cons
Create (K6)	Check knowledge in specific or offbeat situations, Discussion, Debating or Presentations

Mapping with Programme Outcomes:

	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**
CO 1	S							
CO 2			S		S			M
CO 3			S	S	S	S		S
CO 4		M		S				
CO 5			S	S	S	S		S

S-Strong(3) M-Medium (2) L-Low (1)