DEPARTMENT OF BIOTECHNOLOGY				*CLASS: I B.Sc. Biotechnology*				
Sem	**Course Type**	**Course Code**	**Course Title**	**Credits**	**Contact Hours/week**	**CIA**	**Ext**	**Total**
I	Core-1	20U1LMC1	Genetics	3	3	25	75	100

Course Objectives:

1. To apply the principles of inheritance as formulated by Mendel.
2. To understand principles of extensions to Mendelian inheritance, including multiple alleles, lethal alleles, gene interactions, and sex-linked transmission.
3. To describe the cause and consequences of alterations in chromosome number and/or structure.

UNIT-I: Mendelian Inheritance

Historical Background of Genetics. Definition –alleles, homozygous and heterozygous, back cross, test cross and reciprocal cross. Mendel's laws and his experiments –Law of dominance, segregation and independent assortment – Experiments in pea plants. Multiple alleles – ABO Blood groups and Rh factor. Multiple gene inheritance – Skin colour in man, Kernel colour in wheat.

UNIT-II: Deviations from Mendelism

Gene Interactions: complete and incomplete dominance, co-dominance and epistasis. Inter allelic-Complementary gene interaction (9:7) – *Lathyrus odoratus*, Supplementary gene interaction (9:3:4) Grain color in Maize, Epistasis - Dominant - Fruit color in *Cucurbita pepo*, Recessive - Coat color in Mice. Non-Epistasis - Comb pattern in Poultry

UNIT-III: Sex determination, sex-linked and cytoplasmic inheritance

Genetic balance theory of Bridges, Environment and Sex determination - *Drosophila*, Hormonal control of sex determination. Sex linked inheritance and sex influenced inheritance. Cytoplasmic inheritance - Kappa particles in *Paramecium*, shell coiling in snail and plastid inheritance in *Mirablis*

Unit-IV: Linkage and Crossing Over

Linkage: Theory and types of Linkage, linkage groups, factors affecting linkage, Crossing over -mechanism, factors affecting crossing over, tetrad analysis and significance of crossing over.

UNIT-V: Chromosomal aberrations and Population genetics

Chromosomal mutations – types: changes in number and structure, Karyotyping, Non-disjunction - Down syndrome, Klinefelter's syndrome and Turner's syndrome. Eugenics: Positive and Negative Eugenics, Pedigree analysis. Allelic and genotype frequencies, Hardy Weinberg law, factors affecting Hardy Weinberg law, Significance in Population Genetics.

Books for Study

1. Verma PS and Agarwal VK. 2008. Genetics. Eighth Edition. S. Chand Publications
2. Singh BD. 2002. Genetics. Kalyani Publications

Books for Reference

1. Snustad and Simmons. 2012. Principles of Genetics. John Wiley & Sons, Inc.
2. Klug and Cummings. 2012. Concepts in Genetics. Pearson
3. Brooker RJ. 2012. Genetics-Analysis & Principles. The McGraw-Hill Companies, Inc.
4. Sinnott, Dunn and Dobzhansky. Principles of Genetics.

Web Resources

1. http://www.gwumc.edu
2. http://nptel.ac.in
3. http://swayam.gov.in

Pedagogy

The teaching methods may include Chalk and talk, PowerPoint, demonstrations, assignments and group discussions and Problem solving

Course Learning Outcomes:

On completion of this course the students will be able to

#	CLOs	K - Level
CLO-1	Identify the laws of inheritance	Up to K-3
CLO-2	Compare and contrast Mendelian inheritance and Non Mendelian Inheritance	Up to K-3
CLO-3	Interpret the inheritance pattern in both plants and animals	Up to K-4
CLO-4	Comprehensive and detailed understanding of Population Genetics	Up to K-2
CLO-5	Apply reasoning skills to solve genetic problems	Up to K-4

Mapping of Course outcomes with Program specific Outcomes:

CLO/PSO	PSO-1	PSO-2	PSO-3	PSO-4	PSO-5	PSO-6	PSO-7
CLO-1	3	3	1	1	1	--	3
CLO-2	3	2	1	2	2	--	--
CLO-3	3	3	2	2	1	2	--
CLO-4	3	3	3	3	2	1	--
CLO-5	3	3	3	2	2	3	2

Advance application-3; Intermediate level-2; Basic level-1

Mapping of Course outcomes with Program Outcomes:

CO/PO	PO-1	PO-2	PO-3	PO-4	PO-5
CLO-1	3	3	--	3	2
CLO-2	2	--	1	--	3
CLO-3	3	3	1	2	3
CLO-4	1	2	2	2	1
CLO-5	3	2	2	2	3

Advance application-3; Intermediate level-2; Basic level-1

LESSON PLAN

Unit	Description	Staff Name	Hours	Mode
UNIT - I	Historical Background of Genetics. alleles, homozygous and heterozygous, back cross, test cross and reciprocal cross		3	Chalk and talk Problem solving
	Mendel's laws and his experiments –Law of dominance, segregation and independent assortment – Experiments in pea plants.		3	Chalk and talk Problem solving
	Multiple alleles – ABO Blood groups and Rh factor in human beings, Multiple gene inheritance – Skin colour in man, Kernelcolour in wheat.		3	Chalk and talk Problem solving
UNIT - II	Gene Interactions: complete and incomplete dominance, co-dominance and epistasis.		3	Chalk and talk Problem solving
	Inter allelic-Complementary gene interaction (9:7) – *Lathyrus odoratus*, Supplementary gene interaction (9:3:4) Grain color in Maize.		3	Chalk and talk
	Epistasis - Dominant - Fruit color in *Cucurbita pepo*, Recessive - Coat color in Mice. Non-Epistasis - Comb pattern in Poultry.		3	Chalk and talk
UNIT - III	Genetic balance theory of Bridges, Sex determination- *Drosophila*		3	Chalk and talk
	Sex linked inheritance and sex influenced inheritance.		3	Chalk and talk
	Cytoplasmic inheritance – Kappa particles in *Paramecium*, shell coiling in snail and plastid inheritance in *Mirablis*		3	Chalk and talk PPT
UNIT-IV	Linkage theory: Coupling and repulsion, types of Linkage, linkage groups.		4	Chalk and talk PPT
	Crossing over – Mechanism, factors affecting crossing over, tetrad analysis and significance of crossing over.		5	Chalk and talk
UNIT - V	Chromosomal mutations – types: changes in number and structure, Karyotyping, Non-disjunction Down syndrome, Klinefelter's syndrome and Turner's syndrome		3	Chalk and talk
	Eugenics: Positive and Negative Eugenics, Pedigree analysis.		3	Chalk and talk Problem solving
	Allelic and genotype frequencies, Hardy Weinberg law, factors affecting Hardy Weinberg law, Significance in Population Genetics		3	Chalk and talk Problem solving

Learning Outcome Based Education & Assessment (LOBE)

Blue Print – Genetics Course

Articulation Mapping – K Levels with Courses Learning Outcomes (CLOs)

S. No.	CLOs	K-Level	Section A MCQs		Section B Short Answers		Section C (Either / or Choice)	Section D (Open Choice)
			No. of Questions	K-Level	No. of Questions	K-Level		
1.	CLO 1	Up to K 3	2	K1 & K2	1	K1	2 (K1&K1)	1(K3)
2.	CLO 2	Up to K 4	2	K1 & K2	1	K1	2 (K3&K3)	1(K3)
3.	CLO 3	Up to K 4	2	K1 & K2	1	K2	2 (K3&K3)	1(K4)
4.	CLO 4	Up to K 2	2	K1 & K2	1	K2	2 (K2&K2)	1(K2)
5.	CLO 5	Up to K 4	2	K1 & K2	1	K2	2 (K4&K4)	1(K3)
No. of Questions to be asked			10		5		10	5
No. of Questions to be answered			10		5		5	3
Marks for each Question			1		2		5	10
Total Marks for each Section			10		10		25	30

Distribution of Section-wise Marks with K Levels

K Levels	Section A (No Choice)	Section B (No Choice)	Section C (Either/or)	Section D (Open Choice)	Total Marks	% of Marks without choice	Consolidated
K1	5	4	10	-	**19**	15.83	**42%**
K2	5	6	10	10	**31**	25.83	
K3	-	-	20	30	**50**	41.67	**42%**
K4	-	-	10	10	**20**	16.67	**16%**
Total Marks	10	10	50	50	**120**	100.00	**100%**

Distribution of Unit-wise questions with K Levels

Section A	Section B	Section C	Section D
2 Questions for each Unit (K1 & K2 Level)	1 Question from each Unit (K1 & K2 Level)	2 Questions from Unit-I (K1 Level)	1Question from Unit-I (K3 Level)
		2 Questions from Unit-II (K3 Level)	1Question from Unit-II (K3 Level)
		2 Questions from Unit-III (K3 Level)	1Question from Unit-III (K4 Level)
		2 Questions from Unit-IV (K2 Level)	1Question from Unit-IV (K2 Level)
		2 Questions from Unit-V (K4 Level)	1Question from Unit-V (K3 Level)

K1 –Remembering and recalling facts with specific answers

K2 – Basic understanding of facts and stating main ideas with general answers

K3 – Application oriented – Solving Problems

K4 – Examining, analyzing, presentation and make interferences with evidences

Course content designed by Dr. N. Krithiga