



RAFFLES
UNIVERSITY

TEACHING PLAN: Fundamental of Genetics

Faculty Name:- Dr. N. Moses

SCHOOL: (SOAS) SHOOL OF AGRICULTUR AL SCIENCES		ACADEMIC SESSION: 2023-2024		FOR STUDENTS' BATCH: 1 st year 2 nd semester	
1	Course No.	AGN-T-101			
2	Course Title	Fundamental of Genetics			
3	Credits	3			
4	Learning Hours		Contact Hours	72	
			Assessment	9	
			Guided Study	9	
			Total hours	90	
5	Course Objective	1. Acquaint with concepts, scope, and importance of genetics in the field of agriculture 2. Develop the understanding of mendelian principles and their significance in heredity and inheritance of qualitative & quantitative traits 3. To interpret the process and purpose of cell division, linkage, crossing over, gene interaction, sex determination, and blood group genetics 4. To analyze the possible genotypes that could occur in an offspring, according to the genotype of the two parents with help of Probability and Chi-square test			
6	Course Outcomes	1. Explain the scope of studying genetics and cell division ,probability, dominace relationship and epistasis 2. Explain Mendel's law of inheritance and pattern of inheritance genetics linkage and crossing over 3. Explain the structure of DNA and its replication, central dogma of molecular biology protein synthesis and lac operon concept 4. Describe genes structure, chromosomes, explain pleiotropism, pseudoalleles sex linkage, chromosome aberration and mutation 5. Describe Mutation, Qualitative & Quantitative traits cytoplasmic inheritance, genetic disorder and Multiple alleles			
7	Outline syllabus:				
7.01	Paper Code	Unit	Introduction	Page Numbers ¹	Lect ures
7.02	AGN-T-101	Unit I	Unit-1: Pre and Post Mendelian concepts of heredity. mendelian principles of heredity Unit-2: Architecture of chromosome, chromonemeta, chromosome matrix Unit-3:Chromomeres,Centromeres,Secondry constraction Unit-4: Cell division – mitosis, meiosis	1-127	1 to 4

7.03			Unit-5:Probability and Chi-square Unit-6:Dominance relationships, Epistatic interaction with examples		
		Unit II	Unit-1: Multiple alleles, pleiotropism and pseudoalleles Unit-2: Sex determination and sex linkage Unit-3: Sex limited and sex influenced traits, Blood group genetics Unit-4: Linkage and its estimation, crossing over mechanisms Unit-5:Structural and numerical variations in chromosomes and their implications Unit-6:Use of Haploids, Di-haploids and double haploids in Genetics Unit-7: Mutation, classification, Methods of inducing mutation & CIB Technique Unit-8: Mutagenic agents and induction of mutation	135-187	4 to 9
7.04		Unit III	Unit-1: Qualitative & Quantitative traits, Polygenes and continuous variations, Unit-2: Multiple factor hypothesis Unit-3: Cytoplasm inheritance. Genetic disorders Unit-4: Nature, structure & replication of genetic material	174-241	9 to 13
7.05		Unit IV	Unit-1: Protein synthesis, Transcription Unit-2: Gene concept: Gene structure, function and regulation Unit-3: Lac and Trp operons	291-319	13to 16
8	Course Evaluation				
8.1	CA: 10%				
8.11	Attendance	25%			
8.12	Homework	2 Assignments-50%			
8.13	Quizzes	2 Quizzes-25%			
8.14	Projects				
8.15	Presentation				
8.16	Any other	Practical examination-15%			
8.2	MTE	30%			
8.3	End-term examination: 50%				
9	Text Books & References				
9.1	Text book	Elements of Genetics – Phundan Singh Genetics – B. D. Singh Genetics – P. K. Gupta			
9.2	References				
9.3	Video References	1. https://www.youtube.com/watch?v=MepR9w20NcU&t=17s 2. https://www.youtube.com/watch?v=YoOP4FC_dw4 3. https://www.youtube.com/watch?v=iQxtM8SUPiE 4. https://www.youtube.com/watch?v=xgd4LK_C7_8 5. https://www.youtube.com/watch?v=iMx5-323Ogs&t=515s 6. https://www.youtube.com/watch?v=dDJispD2oLM&t=837s 7. https://www.youtube.com/watch?v=T8qDqXwf76c			

Mapping of Outcomes v. Topics

Outcome no. → Syllabus topic↓	1	2	3	4	5
Paper Code.Unit I (1)		✓			
Paper Code. Unit I (2)				✓	
Paper Code. Unit I (3)				✓	
Paper Code.Unit I (4)	✓				
Paper Code. Unit I(5)	✓				
Paper Code. Unit I(6)	✓				
Paper Code.Unit II(1)				✓	
Paper Code. Unit II(2)				✓	
Paper Code. Unit II(3)				✓	
Paper Code.Unit II (4)				✓	
Paper Code. Unit II(5)				✓	
Paper Code. Unit II(6)				✓	
Paper Code.Unit II (7)				✓	
Paper Code. Unit II(8)				✓	
Paper Code. Unit III(1)				✓	✓
Paper Code. Unit III(2)					✓
Paper Code. Unit III(3)					✓
Paper Code. Unit III(4)			✓		
Paper Code. Unit IV(1)			✓		
Paper Code. Unit IV(2)			✓		
Paper Code. Unit IV(3)			✓		

Question Bank

Unit-I

A) Multiple choice questions

1. After cross-fertilization of true-breeding tall and dwarf plants, the F_1 generation was self-fertilized. The resultant plants have genotype in the ratio

- (a) 1:2:1 (homozygous tall : heterozygous tall : dwarf)
- (b) 1:2:1 (heterozygous tall : homozygous tall : dwarf)
- (c) 3:1 (tall : dwarf)
- (d) 3:1 (dwarf : tall)

Answer: (a)

2. Which of the following characteristics of pea plants was not used by Mendel in his experiments?

- (a) Seed colour
- (b) Seed shape
- (c) Pod length
- (d) Flower position

Answer: (c)

3. Mendel took _____ contrasting characteristics of pea plants.

- (a) Eight

- (b) Seven
- (c) Six
- (d) Five

Answer: (b)

4. If both genotype and phenotype shows the same ratios of 1:2:1 in the F_2 generation, it shows

- (a) Incomplete dominance in monohybrid cross
- (b) Complete dominance in monohybrid cross
- (c) Dihybrid cross
- (d) Co-dominance

Answer: (a)

5. Test cross determines

- (a) Whether two traits are linked or not
- (b) The genotype of F_2 plant
- (c) Whether the two species will breed successfully or not
- (d) Number of alleles in a gene

Answer: (b)

B) Write short notes on the following

1. Write down the reason of success of Mendel's experiment.
2. Write down the traits of garden pea along with their alleles chosen by Mendel.
3. Describe the events occurring during interphase.
4. Explain the process of incomplete dominance.
5. Give a diagrammatic account of prophase I of meiosis.

C) Descriptive question

1. Give an account of pre and post Mendelian concept of heredity.
2. Why did Mendel select garden pea for his experiment? Explain.
3. Explain mitotic cell cycle with diagrams.
4. Explain different lethal gene action.
5. Explain law of segregation

Unit-II

A) Multiple choice questions

1. The Phenomenon of two or more than two genes affecting the expression of each other is called ____
 - a) Crossing over
 - b) Pairing
 - c) Gene interaction
 - d) Linkage
2. Which of the following ratio shows complementary gene interaction?
 - a) 9:7
 - b) 15:1

- c) 1:2:1
- d) 9:3:3:
- 3. Which of the following does not show Mendel's law of inheritance?
 - a) Masking gene interaction
 - b) Epistasis
 - c) Supplementary gene interaction
 - d) Codominance
- 4. Which of the following ratio shows supplementary gene interaction?
 - a) 9:7
 - b) 15:1
 - c) 1:2:1
 - d) 9:3:3:
- 5. Which of the following ratio shows dominant gene interaction?
 - a) 9:7
 - b) 15:1
 - c) 1:2:1
 - d) 9:3:3:

B) Write short notes on the following

1. Write down the factors affecting crossing over.
2. Explain different phases of linkage.
3. Briefly explain Map distance.
4. What is sex influenced inheritance?
5. Explain pleiotropism.

C) Descriptive question

1. What is multiple allele? Explain with appropriate example.
2. How would you prepare a chromosome map genetically?
3. Explain different sex linked inheritance.
4. What are linkage groups? Explain the method for detection of linkage.
5. Explain pleiotropism with suitable example

Unit-III

A) Multiple choice questions

1. Which of the following is not true about inversion?
 - a) Inverted chromosomes are generally viable
 - b) Inversion can cause chromosome breakage
 - c) Two DNA strands with an inverted segment will not pair
 - d) Inversion including centromere is known as paracentric
2. Consider this sequence A—O—B —C—D—E—F, be a DNA sequence where O is the centromere. Which of the following will be a pericentric inversion?
 - a) A—O—B—D—E—F
 - b) B—O—A—D—E—F
 - c) D—B—O—A—E—F
 - d) A—O—E—D—B—
3. _____ inversions reduce crossing over in _____
 - a) Paracentric, Heterozygous
 - b) Pericentric, Heterozygous

- c) Paracentric, homozygous
- d) Pericentric homozygous

4. In drosophila male there is no cross over suppression due to pericentric inversion as_____

- a) They have only one set of chromosome
 - b) They always have double cross over
 - c) They never recombine
 - d) They don't undergo meiosis
5. Which of the following is an example of inversion?
- a) Chromosome 22 and 9
 - b) Chromosome 8
 - c) Chromosome 14
 - d) Chromosome 3

B) Write short notes on the following

1. Give an account of different mutagenic agents.
2. Explain plastidial inheritance.
3. Define chromosomal aberrations and its types.
4. Explain with example complementary gene action.
5. What is epistasis? Write down the types of epistatic gene interaction.

C) Descriptive question

1. Give an account of mutation and its types.
2. Explain multiple factor hypotheses with example.
3. Explain with diagram the process of inversion.
4. Differentiate between qualitative and quantitative traits.

Unit-IV

A) Multiple choice questions

1. Which of the following bacteria can synthesize all of the amino acids required for protein synthesis?
 - a) E.coli
 - b) Lactobacillus bravis
 - c) Saccharomyces cerevisiae
 - d) Bacillus subtilis
2. RNAase is a single polypeptide chain of _____ amino acid residues.
 - a) 2
 - b) 350
 - c) 4
 - d) 124
3. Protein synthesis in bacteria takes place on which of the following organelles?
 - a) Endoplasmic Reticulum
 - b) Golgi body

- c) Ribosomes
- d) Mitochondria

4. Which of the following RNA constitutes 90 percent of the total cellular RNA?

- a) rRNA
- b) tRNA
- c) mRNA
- d) hnRNA

5. The synthesis of polynucleotide chain of mRNA is catalyzed by the enzyme

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- a) RNA helicase
 - b) RNA polymerase
 - c) DNA polymerase
 - d) DNA helicase

B) Write short notes on the following

1. Draw the structure of DNA.
2. What are the enzymes involved in DNA replication?
3. Explain briefly the steps involved in transcription.
4. Give a schematic representation of protein synthesis from gene in eukaryotes.
5. What is gene regulation?

C) Descriptive question

1. Explain briefly the process of transcription.
2. Explain the mechanism of translation.
3. Explain gene structure with diagram.
4. Discuss in detail about the steps involved in transcription
5. Explain the mechanism of lac-operon