Printed Page:-03

Subject Code:- BBT0303

Roll. No:

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NOIDA INSTITUTE OF ENGINEERING AND TECHNOLOGY, GREATER NOIDA

(An Autonomous Institute Affiliated to AKTU, Lucknow)

B.Tech

SEM: III - THEORY EXAMINATION (2024 - 2025)

Subject: Genetics and Molecular Biology

Time: 3 Hours Max. Marks: 100

General Instructions:

IMP: *Verify that you have received the question paper with the correct course, code, branch etc.*

*1. This Question paper comprises of three Sections -A, B, & C. It consists of Multiple Choice Questions (MCQ's) & Subjective type questions.*

*2. Maximum marks for each question are indicated on right -hand side of each question.*

*3. Illustrate your answers with neat sketches wherever necessary.*

*4. Assume suitable data if necessary.*

*5. Preferably, write the answers in sequential order.*

*6. No sheet should be left blank. Any written material after a blank sheet will not be evaluated/checked.*



**SECTION-A** 20

1. Attempt all parts:-

1-a. What is the basic unit of chromatin? (CO1, K1) 1

(a) Nucleosome

(b) Centromere

(c) Telomere

(d) Kinetochore

1-b. Which structure is responsible for chromosome movement during cell division? (CO1, K1) 1

(a) Nucleolus

(b) Centrosome

(c) Centromere

(d) Nucleosome

1-c. Who discovered DNA as the genetic material? (CO2, K1) 1

(a) Griffith

(b) Avery, McCarty, and MacLeod

(c) Watson and Crick

(d) Hershey and Chase

1-d. Hershey and Chase used which of the following in their experiment? (CO2, K1) 1

(a) Bacteria and radioactive sulfur

(b) Mice and bacteria

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(c) Bacteriophages and radioactive isotopes
(d) Yeast and fungi

1-e. In prokaryotes, transcription occurs in the: (CO3 , K1) 1
(a) Nucleus
(b) Cytoplasm
(c) Mitochondria
(d) Ribosomes

1-f. What is the enzyme responsible for transcription in prokaryotes? (CO3, K1) 1
(a) DNA polymerase
(b) RNA polymerase
(c) Helicase
(d) Ligase

1-g. What is the role of an activator in gene regulation? (CO4, K1) 1
(a) Inhibits gene expression
(b) Enhances gene expression
(c) Binds to DNA helicase
(d) Binds to ribosomes

1-h. Attenuation is a mechanism of regulation seen in: (CO4, K1) 1
(a) Prokaryotes
(b) Eukaryotes
(c) Viruses
(d) Archaea

1-i. What is Mendel's first law? (CO5, K1) 1
(a) Law of Segregation
(b) Law of Dominance
(c) Law of Independent Assortment
(d) Law of Recombination

1-j. Chi-square test is used in genetics to: (CO5, K1) 1
(a) Test gene expression
(b) Determine dominance
(c) Evaluate the goodness of fit
(d) Find crossing over points

2. Attempt all parts:-

2.a. Identify the phenotypic ratio observed in a dihybrid cross. (CO1, K1) 2

2.b. Describe the primary structures of chromosomes. (CO2, K1) 2

2.c. Classify the types of bonds involved in the DNA double helix structure. (CO3, K2) 2

2.d. Classify the stop codons of the genetic code and explain their significance. (CO4, 2

| | | |
|---|---|---|
| | K2) | |
| 2.e. | Diagram the structure of the lac operon. (CO5, K1) | 2 |

**SECTION-B** 30

3. Answer any five of the following:-

| | | |
|---|---|---|
| 3-a. | Define the chi-square test and outline its application in genetics. (CO1, K2) | 6 |
| 3-b. | Identify the key differences between complete dominance and incomplete dominance with examples. (CO1, K1) | 6 |
| 3-c. | Contrast DNA damage caused by radiation versus chemical mutagens. (CO2, K2) | 6 |
| 3-d. | Contrast the methods for detecting mutations. Explain any one technique used to detect mutations. (CO2, K2) | 6 |
| 3.e. | Demonstrate how PCR can be used in genetic testing. (CO3, K3) | 6 |
| 3.f. | Simplify the elongation phase of translation in prokaryotes. (CO4, K4) | 6 |
| 3.g. | Illustrate the operon model of gene expression? (CO5, K4) | 6 |

**SECTION-C** 50

4. Answer any one of the following:-

| | | |
|---|---|---|
| 4-a. | Outline the concept of multiple alleles and describe their significance using the ABO blood group system. (CO1, K1) | 10 |
| 4-b. | Define Hardy-Weinberg equilibrium and describe its applications in population genetics. (CO1, K1) | 10 |

5. Answer any one of the following:-

| | | |
|---|---|---|
| 5-a. | Discuss the principles and clinical applications of fluorescence in situ hybridization (FISH). (CO2, K2) | 10 |
| 5-b. | Describe the process of homologous recombination and its role in DNA repair. (CO2, K2) | 10 |

6. Answer any one of the following:-

| | | |
|---|---|---|
| 6-a. | Break down the entire process of DNA replication in eukaryotes, categorizing the roles of key enzymes. (CO3, K4) | 10 |
| 6-b. | Use the Meselson-Stahl experiment to demonstrate the concept of semi-conservative replication. (CO3, K3) | 10 |

7. Answer any one of the following:-

| | | |
|---|---|---|
| 7-a. | Simplify the steps involved in tRNA charging and its role in translation. (CO4, K4) | 10 |
| 7-b. | Simplify the differences between Rho-dependent and Rho-independent termination of transcription. (CO4, K4) | 10 |

8. Answer any one of the following:-

| | | |
|---|---|---|
| 8-a. | Diagram the process of alternative splicing and analyze its role in proteome diversity. (CO5, K4) | 10 |
| 8-b. | Illustrate the pathways of protein folding and stability and analyze their importance in cellular function. (CO5, K4) | 10 |