MZO-002

ASSIGNMENT BOOKLET

M.Sc. (Zoology) Programme

(MSCZOO)

(GENETICS AND ANIMAL BIOTECHNOLOGY)

Valid from 1st January, 2026 to 31st December, 2026

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THE PEOPLE'S UNIVERSITY

School of Sciences
Indira Gandhi National Open University
Maidan Garhi, New Delhi-110068

(2026)

Dear Student,

Please read the Section on assignments in the Programme Guide for M.Sc. (Zoology). A weightage of 30%, as you are aware, has been earmarked for continuous evaluation, which would consist of one tutor-marked assignment for this course. The assignment is in this booklet. The total marks for this assignment is 100, of which 40 marks are needed to pass it.

Instructions for formatting your Assignments

Before attempting the assignment please read the following instructions carefully:

1) On top of the first page of your answer sheet, please write the details exactly in the following format:

ROLL NO.: ……………………………………………

NAME: ………………………………………………..

ADDRESS: ……………………………………………

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COURSE CODE: …………………………….

COURSE TITLE: …………………………….

ASSIGNMENT NO.: ……………………………..…

STUDY CENTRE: ……………………………..….... **DATE:** ……………………….……………

PLEASE FOLLOW THE ABOVE FORMAT STRICTLY TO FACILITATE EVALUATION AND TO AVOID DELAY.

2) Use only foolscap size writing paper (but not of very thin variety) for writing your answers.

3) Leave 4 cm margin on the left, top and bottom of your answer sheet.

4) Your answers should be precise.

5) Solve this assignment, and **submit the complete assignment answer sheets within the due date.**

6) The assignment answer sheets are to be submitted to your Study Centre within the due date. **Answer sheets received after the due date shall not be accepted. We strongly suggest that you retain a copy of your answer sheets.**

7) **This assignment is valid from 1st January, 2026 to 31st December, 2026**. If you have failed in this assignment or fail to submit it till its validity, then you need to get the assignment for the next year and submit it as per the instructions given in the Programme Guide.

8) **You cannot fill the examination form for this course** until you have submitted this assignment.

We wish you good luck.

ASSIGNMENT
(Tutor Marked Assignment)

Course Code: MZO-002
Assignment Code: MZO-002/TMA/2026
Maximum Marks: 100

Note: Attempt all questions. The marks for each question are indicated against it.

1. (a) Explain Mendel's Law of Segregation and Independent Assortment with examples, accounting for 3:1 and 9:3:3:1 F_2 ratios in monohybrid and dihybrid crosses. (5)

   (b) Describe the phenomenon of duplicate genes with cumulative effect with suitable examples. How does this type of gene interaction modify the expected Mendelian ratio, and what phenotypic ratio is observed in the F_2 generation of such crosses? (5)

2. (a) Briefly describe different gene types in eukaryotes with examples, highlighting the functional significance. (5)

   (b) Explain human gene mapping by linkage analysis in pedigrees using nail-patella syndrome and ABO blood group example, including recombination frequency calculation. (5)

3. Compare spontaneous *vs.* induced mutations, explaining DNA replication errors, tautomeric shifts, depurination, UV-induced thymine dimers, and 5BU base analog effects. (10)

4. Explain positive and negative control mechanisms in prokaryotic gene expression, distinguishing inducible/repressible systems with diagrams of activator/repressor binding to RPBS and effector molecule effects. (10)

5. Describe eukaryotic gene structure and evolutionary role of introns in exon shuffling. (10)

6. Describe general/specific transcription factors, their roles in eukaryotic transcription initiation, DNA-binding motifs and cis-regulatory elements. (10)

7. Explain Drosophila sex determination by Genic Balance Theory (X/A ratio), Calvin Bridges' experiments, and molecular pathway involving *sxl*, *tra*, *tra-2*, and *dsx* genes. (10)

8. Explain artificial selection using narrow-sense heritability, selection differential/response to selection, QTL mapping, and heritability estimates for human intelligence/personality traits. (10)

9. (a) Compare direct, indirect, sandwich, and competitive ELISA techniques, their principles, advantages, and applications. (5)

   (b) Describe steps in cloning eukaryotic insulin genes in prokaryotes for recombinant human insulin production using synthetic A/B chains and fusion proteins. (5)

10. Compare non-viral *vs.* viral vectors in gene therapy, their advantages/disadvantages, and applications in treating cystic fibrosis, hemophilia, cancer, and dermatological disorders. (10)