FEDERAL UNIVERSITY OF TECHNOLOGY, MINNA

DEPARTMENT OF MICROBIOLOGY,

FIRST SEMESTER EXAMINATION 2022/2023 SESSION

COURSE: MICROBIAL GENETICS AND MOLECULAR BIOLOGY (MCB 415)/3 UNITS

INSTRUCTION: Answer FIVE (5) Questions in All; At least TWO (2) Questions from EACH Section. Section A (Questions 1a-f) is Compulsory.

DATE: 8th September, 2023_:300pm **Time Allowed: 2 Hours 30 Minutes**

SECTION A

1. **(a).** Describe in a few words the process of inserting a gene into the host genome in genetic engineering. What is the phenomenon called?
   (b). Describe concisely the structure of bacterial chromosome.
   (c). Enumerate seventeen (17) and eight (8) types of genes and genome respectively.
   (d). What are mutants and mutagen?
   (e). Describe excision repair and the two main categories.
   (f). A donor transforming double-stranded DNA that attached to the recipient cell surface has gene conferring streptomycin resistance (Str^R) while the recipient DNA has gene conferring streptomycin sensitive (Str^S).
   (i). Describe the product of this process.
   (ii). How many cells are formed when the end-products in **(i)** undergo replication?
   (iii). Provide a suitable name for the cells formed in **(ii).**
   (iv). What happens if the cells are grown on medium that contains streptomycin?
   (v). What is the name of the process whereby the donor DNA replaces the recipient DNA precisely in the aforementioned phenomenon?
   (vi). What is the mechanism of recombination in which the homologous region of the recipient DNA is replaced by donor DNA in the aforementioned phenomenon?

2. **(a).** What is the significance of degradative plasmid found in *Burkholderia hospita*?
   (b). Describe the different types/forms of DNA.
   (c). How many base pairs would have to be deleted in a mutational event to eliminate a single amino acid from a protein and not change the rest of the protein?

3. **(a).** What would happen to the duplex structure of the double-stranded DNA introduced into a cup of hot coffee tea?
   (b). Elucidate how sex is determine in bacteria.

4. **(a).** Briefly elucidate the salient characteristics of DNA structure as regards to its reliability and fidelity generation after generation.
   (b). It is physically separated from the chromosomal DNA within a cell. What is the name of the genetic structure?
   (c). Lifeless bacteria of one strain confer virulence to another strain. Provide a suitable name for the above process.

SECTION B

5. In replication, template strand **A** moves in $\mathbf{3^1\text{-}5^1}$ direction while template strand **B** moves in $\mathbf{5^1\text{-}3^1}$ direction.

(a) What is the complementary strand of **B** called and why?

(b) Describe the replication of **B,** specifying the enzymes involved.

(c) Mention two differences between conjugation and high frequency recombination.

6. An mRNA carrying the sequence $\mathbf{3^1}$AUGAGCAUAUAA $\mathbf{5^1}$ is to be transformed into protein **Z.**

(a) What is the above process called?

(b) What is the amino acid sequence for protein **Z**?

(c) What is gene regulation?

7. **(a)** What is the difference between structural genes and regulatory genes?

(b) What does **m** & **t** in mRNA and tRNA stands for and what is their function in gene expression?

(c) Mention four **(4)** enzymes involved in replication and their functions.