KATHMANDU UNIVERSITY
End Semester Examination
May/June, 2022

Level : B.Tech.
Year : II
Time : 2 hrs. 30 mins.

Course : BIOT 206
Semester : II
F.M. : 55

Indicate by checking (√) of each question you have answered in the cover page of main answer book.

SECTION "B"
[5Q. × 3 = 15 marks]

Attempt *ANY FIVE* questions.

1. Why does major groove contain more information than minor groove?
2. Describe protein interaction with protein and protein interaction with RNA.
3. Describe RNAase P.
4. Describe how is LC/MS used to identify proteins.
5. Describe the contacts that maintain interaction between histones and DNA?
6. Describe incorporation assay.
7. What kind of DNA damage does ultraviolet radiation cause?

SECTION "C"
[5Q. × 5 = 25 marks]

Attempt *ANY FIVE* questions.

8. Describe hydrogen bond and van der Waal's forces in terms of bond strength, valency and bond length.
9. Describe the three major forms of DNA.
10. Describe SELEX.
11. Describe the organization and content of human genome.
12. Describe nucleosome remodeling complexes.
13. How are replicators (ARS) identified in the genome?
14. Describe nucleotide excision repair.

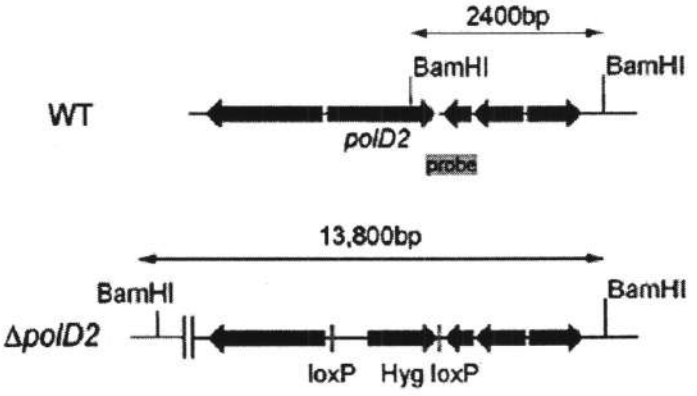
SECTION "D"

[2Q. × 7.5 = 15 marks]

Attempt *ANY TWO* questions.

15. Explain how the directionality of protein synthesis (N to C terminus or C to N terminus) was established. How did Hershey Chase experiment establish that DNA was the genetic material? [4 + 3.5]

16. Describe the technique of Southern Blot. [3.5]



Above shown is the genetic map of two strain of Mycobacterium smegmatis, wild type and delta polD2. Bold arrows indicate genes. Delta polD2 strain was created by replacing polD2 gene with hygromycin gene. Devise a strategy using BamHI restriction enzyme to differentiate between the two strains using Southern Blot. [4]

17. Describe the Trombone model of DNA replication using illustrations. Draw events that happen with time. [3.5 + 4]

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Exam Roll No:
Time : 30 mins.
F.M. : 20

Registration No:
Date : June-27, 022

SECTION "A"
[20Q. × 1 = 20 Marks]

Encircle the most appropriate option.

1. In the Messelson and Stahl experiment what will be the band pattern of DNA observed if the dispersive method of replication were true in the third generation of bacteria transferred to regular Nitrogen media?
   a. One band between N14 and N15 bands
   b. One band at N14, another band between N14 and N15
   c. One band at N15
   d. One band at N15, another band between N14 and N15

2. Which of the following about Chargaff's experiment is NOT correct?
   a. Chargaff's rule helped in the determination of DNA structure
   b. Chargaff used Gas Chromatography to get his results
   c. According to his rule the ratio of pyrimidine and purine is 1 in all organisms
   d. The significance of Chargaff's rule is that A pairs with T and G pairs with C

3. Why are triphosphates used as precursors instead of diphosphates
   a. Triphosphates release more energy than diphosphates
   b. Enzymes are suited more for triphosphates
   c. The pyrophosphate released can be further converted to phosphate favoring the reaction
   d. Triphosphates are more available than diphosphates in cells

4. What about the structure of DNA is true
   a. It is a polymer of nucleotide di phosphate
   b. It contains phosphodiester bond
   c. It forms zwitterion that has both a positive and a negative charge
   d. A newly synthesized strand has triphosphates at 3'end

5. When DNA is moved from propanol to water, which of the following is most closely accurate
   a. Linking number increases
   b. Linking number decreases
   c. Writhe changes because periodicity changes
   d. Periodicity changes hence twist changes

6. Which of the following is a three-helix bundle that fits into minor groove?
   a. Lymphocyte enhancer factor 1
   b. Zinc finger motif
   c. Bacteriophage lamda repressor
   d. Yeast transcription factor GCN4

7. What does mutate and map strategy do:
   a. It determines structure of protein through mutations
   b. It determines structure of RNA through some computation
   c. It determines structure of DNA and RNA through some computation
   d. It determines structure of RNA through all mutation and no computation.

8. XhoI is a restriction enzyme that does not cut Mycobacterium genome. Which of the following is a probable cause
   a. Six base pair cutters don't work in mycobacteria
   b. There is a methylase that recognizes and methylates XhoI site in mycobacteria
   c. Restriction enzyme from one bacteria gets inactivated by the genome of another bacteria
   d. XhoI gets inactivated by protein contamination from genome

9. Expression vector:
   a. cannot be cut by restriction enzymes
   b. is actually a phage vector
   c. is a type of cloning vector
   d. is often not a plasmid

10. Two primers amplify a gene from E. coli DNA. After the first round of amplification what about the amplification product is true
   a. The amplification product contains the entire genome
   b. Amplification leads to exact gene amplification
   c. Amplification leads to amplification of gene and flanks from either side
   d. There is no amplification product

11. Which of the following is not a type of protein column used for protein purification
   a. Polyacrylamide b. Ion exchange c. Gel filtration d. Affinity

12. A novel single celled amoeba was discovered. What is probably the most likely description of its genome
   a. It contains a lot of introns
   b. It contains pseudogenes
   c. It contains transposable elements
   d. Its size is roughly 10 Mb

13. What is nucleosome core particle?
   a. DNA and associated histone before micronuclease treatment
   b. DNA and associated histone after very mild nuclease treatment
   c. DNA and associated histone after strong nuclease treatment
   d. DNA and associated histone after alkaline treatment

14. For each histone protein wrapped around by DNA the linking number does not change by -1.65 because
   a. the DNA slightly changes its bases per turn.
   b. linking number is a factor of only writhe.
   c. the writhe changes.
   d. the DNA slightly changes its diameter.

15. DNA polymerization reaction is a SN2 reaction. Here:
   a. 5 prime phosphate attacks the incoming alpha phosphate
   b. 5 prime OH attacks the incoming alpha phosphate
   c. 3 prime phosphate attacks the incoming alpha phosphate
   d. 3 prime OH attacks the incoming alpha phosphate

16. A sliding clamp
    a. Fits into single stranded DNA
    b. Is found as PCNA in bacteria
    c. Is found as dimer of three domain protein in bacteria
    d. Is found as dimer of three domain protein in archaea

17. Translesion Synthesis (TLS) means
    a. Synthesizing across any DNA
    b. Synthesizing across errors in DNA
    c. Synthesizing across replication fork in DNA
    d. Synthesizing across lagging strand of DNA

18. Helicase
    a. Can only fit double stranded DNA
    b. Can run 5 prime to 3 prime or 3 prime to 5 prime
    c. Removes torsional stress of DNA
    d. Is pentameric

19. Direct reversal of DNA damage does not include:
    a. Photo reversal of pyrimidine dimer
    b. Removal of methyl group from methyl guanine
    c. Activity of photolyase enzyme
    d. Removal of uracil from genome

20. Which of the following is NOT a component of NHEJ?
    a. RecA protein b. DNA PKc c. Ku protein d. ARTEMIS