

Name:

Enrolment No:



UNIVERSITY OF PETROLEUM AND ENERGY STUDIES

End Semester Examination, May 2023

Course: Molecular Biology and Genetics

Program: M.Sc. Microbiology

Course Code: HSMB7026

Semester : II

Duration : 3 Hours

Max. Marks: 100

Instructions: Read all questions carefully

S. No.	Section A Short answer questions/ MCQ/T&F (20Qx1.5M= 30 Marks)	Marks	COs
Q 1	Mode of DNA replication in <i>E.coli</i> is (A) Conservative and unidirectional (B) Semiconservative and unidirectional (C) Conservative and bidirectional (D) Semiconservative and bidirectional	1.5	CO1
Q 2	When DNA replication starts (A) The phosphodiester bonds between the adjacent nucleotides break (B) The bonds between the nitrogen base and deoxyribose sugar break (C) The leading strand produces Okazaki fragments (D) The hydrogen bonds between the nucleotides of two-strands break	1.5	CO1
Q 3	Unwinding of DNA is done by (A) Helicase (B) Ligase (C) Hexonuclease (D) Topoisomerase	1.5	CO1
Q 4	The process involved in the RNA formation on the DNA template is (A) Transcription (B) Translation (C) Replication (D) Transformation	1.5	CO1
Q 5	A promoter site on DNA (A) Initiates transcription (B) Regulates termination (C) Codes for RNA (D) Transcribes repressor	1.5	CO2
Q 6	The Sigma factor is a component of (A) DNA ligase (B) DNA polymerase (C) RNA polymerase (D) Endonuclease	1.5	CO2

Q 7	Which site of tRNA molecule hydrogen bonds to a mRNA molecule? (A) Codon (B) Anticodon (C) 5' end of the tRNA molecule (D) 3' end of the tRNA molecule	1.5	CO2
Q 8	Genetic code is (A) the sequence of nitrogenous bases in mRNA molecule that codes for a protein (B) is a triplet code (C) is non-overlapping (D) all of these	1.5	CO2
Q 9	During translation, proteins are synthesized (A) by ribosomes using the information on DNA (B) by lysosome using the information on DNA (C) by ribosomes using the information on mRNA (D) by ribosomes using the information on rRNA	1.5	CO3
Q 10	Which of the following RNA molecules serves as an adaptor molecule during protein synthesis? (A) rRNA (B) mRNA (C) tRNA (D) Both B and C	1.5	CO3
Q 11	Which energy rich molecule required for initiation of translation? (A) ATP (B) GTP (C) CTP (D) AMP	1.5	CO3
Q 12	Tetracycline blocks protein synthesis by (A) inhibiting binding of aminoacyl tRNA to ribosome (B) inhibiting initiation of translation (C) inhibiting peptidyl transferase (D) inhibiting translocase enzyme	1.5	CO3
Q 13	Which of the following biomolecules has self-repair mechanisms? (A) DNA, RNA and protein (B) DNA and RNA (C) DNA only (D) DNA and proteins	1.5	CO4
Q 14	After bound to the mRNA eukaryotic ribosome scans the entire mRNA until it encounters a start codon (A) True (B) False	1.5	CO4
Q 15	How many loops are seen in the tRNA? (A) 1 (B) 2 (C) 3 (D) 4	1.5	CO4
Q 16	Which of the following component of spliceosome recognizes the 3' splice site? (A) U2 (B) U2AF (C) BBP (D) U4	1.5	CO4

Q 17	In man, which of the following genotypes and phenotypes may be the correct result of aneuploidy in sex chromosomes? (A) 22 pairs + Y females (B) 22 pairs + XX females (C) 22 pairs + XXY males (D) 22 pairs + XXXY females	1.5	CO5
Q 18	Which of the following would most likely cause a mutation with the greatest deleterious effect? (A) An insertion of a nucleotide triplet into a DNA strand that codes for an mRNA (B) A single addition of a nucleotide in a DNA strand that codes for an mRNA (C) A deletion of a nucleotide triplet from a DNA strand that codes for an mRNA (D) All of these	1.5	CO5
Q 19	A woman with one gene for hemophilia and one gene for color blindness on one of the X chromosomes marries a normal man. How will the progeny be?? (A) Hemophilic and color-blind daughters (B) All sons and daughters are hemophilic and color blind (C) 50% hemophilic and color-blind sons and 50% normal sons (D) 50% hemophilic color-blind sons and 50% color blind daughter	1.5	CO5
Q 20	The tendency of offspring to differ from parents is called (A) variation (B) heredity (C) inheritance (D) resemblance	1.5	CO5
Section B (4Qx5M=20 Marks)			
Q 1	Draw the structure of tRNA and label the five loops?	5	CO1
Q 2	Differentiate the ribosomes & ribosomal subunits of prokaryotes and eukaryotes in detail.	5	CO2
Q 3	What is C ₀ t curve and write its application	5	CO3
Q 4	What is alternative splicing and why does it occur in eukaryotes?	5	CO1

Section C
(2Qx15M=30 Marks)

Q 1



15
(5+5+5)

CO2

A. A hypothetical mRNA with 12 codons is shown above. How many amino acids will be coded by this? Justify your answer. Mention the dual function of the codon, AUG.

B. Listed below are some amino acids and their corresponding mRNA triplets.

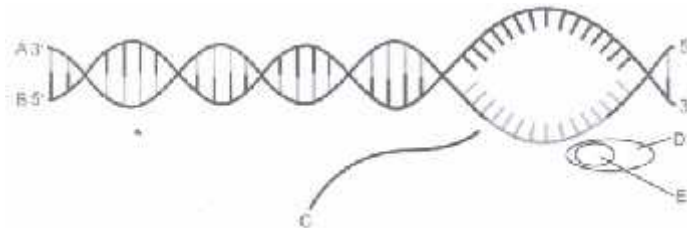
Amino acid	mRNA triplet
Phenylalanine	UUU
Lysine	AAG
Arginine	CGA
Alanine	GCA

Which DNA sequence would be needed to produce the following peptide sequence? Alanine-arginine-Lysine-Phenylalanine

- (i) CGT GCT TTC AAA
- (ii) CGT GCT TTC TTT
- (iii) CGU GCU UUC AAA
- (iv) CGU GCU UUC TTT

C. A particular stage in the transcription of a bacterium is given below. Answer the following questions.

- (i) Name the stage in the process.
- (ii) Identify A, B, C, D, and E in the diagram

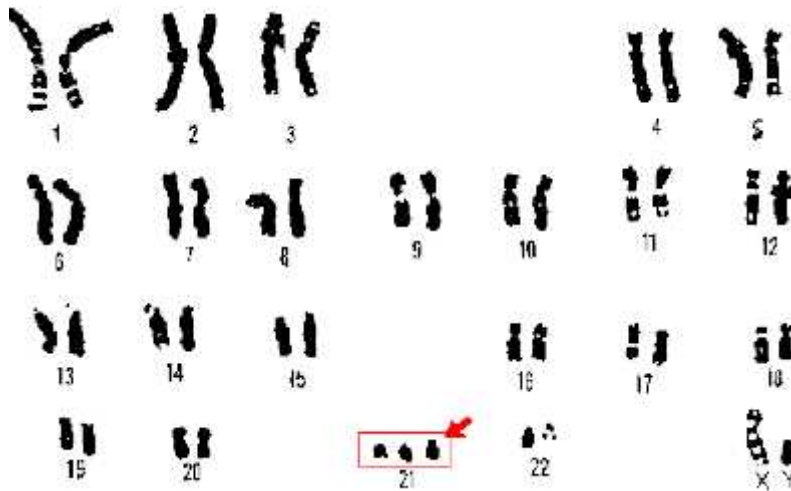


Q 2

15

CO3

A.



- (i) For the above karyotype, characterize the aneuploidy?
- (ii) For the individual with the karyotype above, which sex would be most likely be assigned at birth?
- (iii) Provide the official name of the disorder/syndrome associated with results from karyotype above

B. A scientist cross pure-bred tall (dominant) pea plant with pure-bred dwarf (recessive) pea plant he will get pea plants of F1 generation. If now self-cross the pea plant of F2 generation is done, then we obtain pea plants of F2 generation

- (i) State the type of plants not found in F1 generation but appeared in F2 generation, mentioning the reason for the same
- (ii) State the ratio of tall plants to dwarf plants in F2 generation
- (iii) What do the plants of F2 generation look like?
- (iv) Draw the punnett square for the F1 and F2 generation
- (v) What was the genotypic ratio of monohybrid cross?

Section D
(2Qx10M=20 Marks)

Q 1	Differentiate between DNA and RNA in a tabular form. List the different types of RNA and their functions.	10	CO4
Q 2	Write the process of eukaryotic transcription in detail with an illustration	10	CO5