

BITS, PILANI- DUBAI
DUBAI INTERNATIONAL ACADEMIC CITY
SECOND SEMESTER 2010-2011
COMPREHENSIVE EXAM

COURSE NO.: BIOT C216 **07.06.11** **MAXIMUM MARKS: 40**
COURSE TITLE: Introductory Molecular Biology **DURATION: 3 Hours**

Answer to the point; Answer all questions in the given sequence

- Q1. (a) Depict a dinucleotide and clearly mark the major bonds involved in its structure. [1]
- (b) Define the following terms: [5]
- i) Gene cloning
 - ii) G + C content
 - iii) D Loop
 - iv) Gene Activator Protein
 - v) Wobble hypothesis
 - vi) Mutator genes
 - vii) RNA Editing
 - viii) Lysogenic life cycle
 - ix) Conjugation
 - x) Genomic library
- (c) Write about two regions of the tRNA molecule which play a major role in the translation / decoding process. [2]
- (d) Explain mechanism of recombinational bypass [repair] by means of a clear diagram. [Only the diagram is needed] [2]
- Q2. (a) Depict the initially proposed tetra-nucleotide structure of DNA. [1]
- (b) Write the salient features of the Galactose operon. How is it similar and different to the Arabinose operon? [In Points] [3]
- (c) Name the two different methods by which posttranscriptional control is achieved. [In prokaryotes] [1]
- (d) Name the known alternate structures of DNA and also mention the major characteristic feature of each family. [1]
- (e) What are the most prevalent interactions responsible for the tertiary structure of the protein? [1]
- (f) Summarize how the three classes of transcripts are regulated in E.coli Phase T7. [3]
- Q3. (a) Describe the major features of transcriptional regulation of RNA Polymerase II-transcribed genes. [In eukaryotes] [3]
- (b) What are two important characteristic features of restriction enzymes? [1]
- (c) Write the major characteristic features of the pattern noticed in DNA sequence-specific protein binding. [3]

- (d) The DNA molecule is extremely stable physically and chemically. Justify. [1]
(e) What are topoisomerases? How do the two types of the enzyme differ from one another? [1]
(f) Depict a growing replication fork showing the direction of growth of the leading and lagging strands. [1]

Q4. (a) Answer the following in one or two words: [5]

- i) Write the -35 consensus sequence
- ii) Name the intercistronic sequences in a polycistronic mRNA molecule
- iii) Name of the elongation protein that facilitates delivery of charged tRNA to the A site
- iv) Phenomenon where different proteins obtain some or all of their primary structure from shared base sequences is known as _____
- v) IPTG is an abbreviation for:
- vi) MMS is an abbreviation for:
- vii) One example of the mode "differential promoter selection" is _____
- viii) Site-specific mutagenesis is otherwise called as _____
- ix) A _____ superhelix results from decreasing the number of times the strands cross
- x) Name the two types of β structure in polypeptides

- (b) Write the major essential chemical characteristics of the transcription process. [2]
(c) Depict the Hershey-Chase blender experiment pictorially. [Only the diagram is required; No theory] [2]
(d) In E.coli, how does the mismatch repair system distinguish between the correct base in the parental strand from the incorrect base in the daughter strand? [1]

BITS, PILANI- DUBAI
DUBAI INTERNATIONAL ACADEMIC CITY
SECOND SEMESTER 2010-2011
TEST – II (OPEN BOOK)

COURSE NO.: BIOT C216 **01.05.11** **MAXIMUM MARKS: 20**

COURSE TITLE: Introductory Molecular Biology **DURATION: 50 Minutes**

Answer to the point; Answer all questions in the given sequence

Q1. (a) What is the significance of the following sequence:
AUUACUGGCUCUUUUUGGAGCCUUUUU? [1]

(b) Original DNA: 3'- TTACCGGATGCAACTTACTGG -5'
5'- AATGGCCTACGTTGAATGACC -3'

HINT: For questions iv) to vii) consider all possible lines of defense [repair mechanisms].

i) mRNA formed after transcription [0.5]

ii) tRNA anti-codons [0.5]

iii) Peptide (protein) sequence formed after translation [0.5]

iv) If a mutation occurs in the Original DNA – [1]

3'- TTACCGGATGCAACTTACTGG -5'

5'- AATGGCCTACGTTGAATGACA -3'

How many repair systems are available in the body to correct this error? What are they?

v) If a mutation occurs in the Original DNA – [2]

3'- TTACCGGATGCAACTTACTGG -5'

5'- AATGGCCTACGTTGAATGACT -3'

How many different repair systems are available in the body to correct this error? What are they?

vi) If a mutation occurs in the Original DNA – [2]

3'- TTACCGGATGCAACTTACTGMeG -5'

Which repair mechanism will be used in this case?

vii) If the original DNA replicates to give [2.5]

3'- TTACCGGATACAACCTTACTGG -5'

5'- AATGGCCTAUGTTGAATGACC -3'

What possible error has caused this? How will this error be corrected? Show process schematically.

(c) It is possible that the polymerization enzymes evolved their 5' – 3' directionality to facilitate editing of mistakes. Explain the above statement SCHEMATICALLY. [2]

Q2. (a) Give a specific example of a process in which the catalytic activity of an enzyme is inhibited? [2]

(b) The lactose system is an inducible system. Justify. [2]

(c) Write down the four major points of difference between eukaryotic and prokaryotic mRNA. [2]

(d) How does the location of AUG codons matter in a polycistronic mRNA? [2]

BITS, PILANI- DUBAI
DUBAI INTERNATIONAL ACADEMIC CITY
SECOND SEMESTER 2010-2011
TEST – I (CLOSED BOOK)

COURSE NO.: BIOT C216

10.03.11

MAXIMUM MARKS: 25

COURSE TITLE: Introductory Molecular Biology

DURATION: 50 Minutes

Answer to the point; Answer all questions in the given sequence

Q1. (a) What is DNA – RNA hybridization? Explain the steps involved in hybridization. [3]

(b) What general rules / tendencies does the folding of the polypeptide chain depend on? [3]

(c) Differentiate between i) alpha and beta secondary structures ii) Fibrous and globular proteins iii) Integral and Peripheral Proteins [2 Major points each] [3]

(d) Name the major noncovalent interactions that determine the 3D structures of proteins and nucleic acids. [1]

Q2. (a) The following is the gel pattern obtained from a DNA sequencing reaction: [3]

A Track C Track G Track T Track

Determine the template sequence. [Marks will be allotted for step-wise solution]

(b) Name two characteristic features of histones. [2]

(c) How are Hemoglobin, DNA Polymerase III and RNA Polymerase similar? Name any other molecule that can be placed in the same category and explain its major structural properties. [3]

(d) Write the equations of the transformation experiments. [2]

Q3. (a) What is supercoiling? What are the different types of supercoiling? How are they different? [2]

(b) What is meant by (i) Base-stacking (ii) Chromatin (iii) Affinity of E and S and (iv) Nucleoid [2]

(c) In the 1800s, it was common wisdom that the genetic material was more likely to consist of proteins. Why was this “common wisdom”? [1]

NAME: _____ ID NO. _____

BITS, PILANI –DUBAI
DUBAI INTERNATIONAL ACADEMIC CITY
SECOND SEMESTER 2010-2011

QUIZ-2 [17.05.11]

COURSE NO.: BIOT C216 MAXIMUM MARKS: 07 DURATION: 20 min.

TITLE: Introductory Molecular Biology

Q1. Name one major similarity and one major difference between TFIID and TFIIE? [1]

Q2. Show an example of differential polyadenylation site selection **schematically**. [1]

Q3. In DNA, sites of methylation and overall amount of methylation are equally crucial. State True / False and Justify your answer. [1]

Q4. State the major function of [2]

(a) Ferritin: _____

(b) F Pilus: _____

(c) Rep Protein: _____

(d) Endolysin: _____

NAME: _____ ID NO. _____

Q5. What is circular permutation? [W.r.t. phages] [1]

Q6. What are restriction maps? [0.5]

Q7. What is site-specific mutagenesis? [0.5]

Name:

ID No.:

BITS, PILANI –DUBAI
DUBAI INTERNATIONAL ACADEMIC CITY
SECOND SEMESTER 2010-2011

QUIZ-1 [05.04.11]

COURSE NO.: BIOT C216

MAXIMUM MARKS: 08

DURATION: 20 min.

TITLE: Introductory Molecular Biology

Q1. Name the two general types of initiation processes of DNA Replication and mention the key difference between them. [1]

Q2. What is the direction of mRNA synthesis? Why? [1]

Q3. Differentiate between a holoenzyme and a core enzyme: [1]

Q4. Significance of the following sequence – TACTACCGCGTAGTA [1]

Q5. A particular tRNA responds only to the codon: GCG. Anticodon is: _____ [1]

[Hint: Use Wobble Phenomenon]

Q6. Define a mischarged transfer RNA: [0.5x6=3 marks]

Q7. Reading frame is: _____

Q8. Significance of 7-MeG: _____

Q9. Write the -10 Consensus Sequence: _____

Q10. The sequence “AGGAGGU” is known as _____

Q11. Function of ssb proteins: _____