MANIPAL INSTITUTE OF TECHNOLOGY

MANIPAL

A Constituent Institution of Manipal University

I SEMESTER B.TECH. INTERNAL EXAMINATIONS DECEMBER 2021

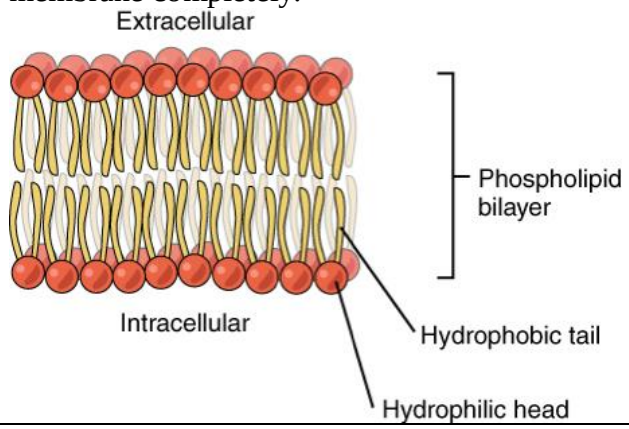
MIDTERM TEST

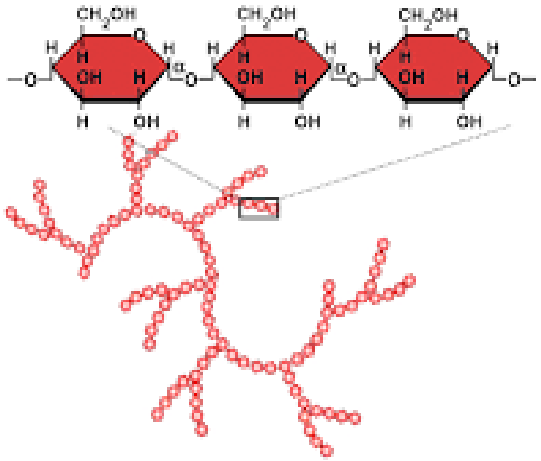
SUBJECT: Biology for Engineers [BIO 1051]

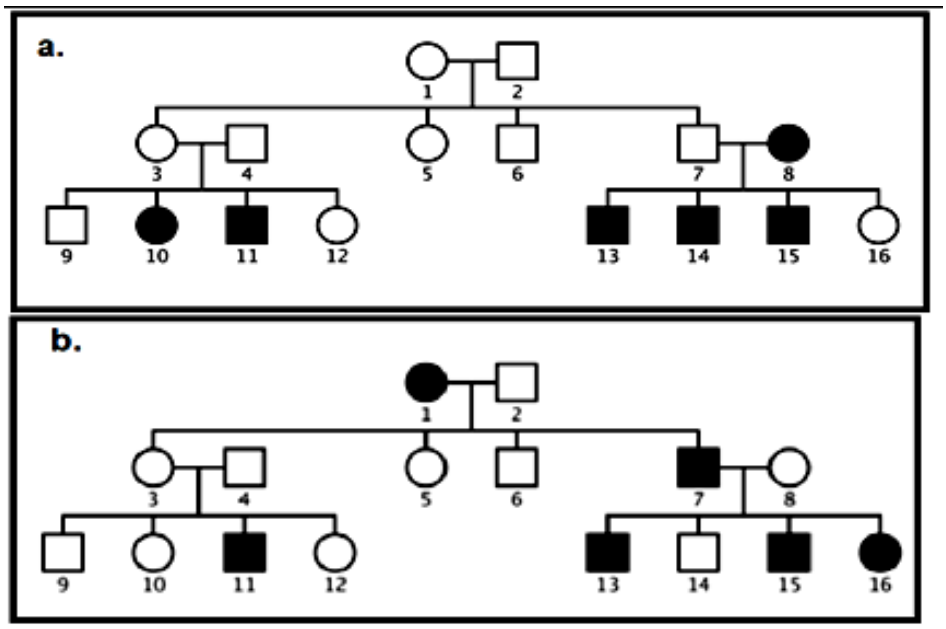
Date of Exam: **18/06/2021** Time of Exam:--**:-- 10 AM – 12.15 PM** Max. Marks: **30**

Instructions to Candidates:

- Answer ALL the questions & missing data may be suitable assumed

1.	Observe the given figure of the cell membrane and design a biomolecule partially made up of proteins and partially consisting of carbohydrates which traverses the membrane completely. 	2
2.	The below results are from Meselson-Stahl technique for a new bacterial DNA.How would you interpret the results? 	2
3.	Assume that a virus with double-stranded RNA has infected human cells: (i) Justify if this virus will be able to use human polymerase for its replication? (ii) It was reported that the virus was able to produce four different viral proteins using the same RNA transcript. How the virus is able to do so?	2
4.	Identify the molecule given below? Can humans metabolize or digest this molecule and utilize it as source of energy? Rationalize.	2

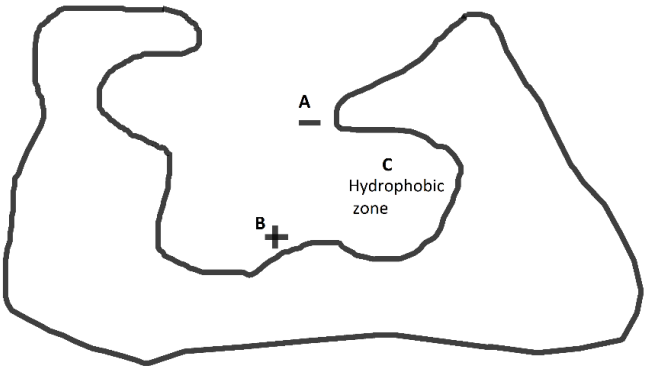


5.	Point mutations (**Red bold**) was observed in the following DNA coding strand after replication process. The mutated sequence is shown below: 5'GTGTCCGTCAAATATTGT**G**AGATGTTATATCCCGCCGTCAACACCA TCAACAGGT**A**AAATCGCCTGCTGGGGCAAAGGCGGTGGGG3' **a.** Which nucleotide base has free Phosphate and Hydroxyl group? ***(1)*** b. If the mutation has replaced "T" with "G". Will there be any change in the mRNA and the protein sequence due to the mutation? Justify your answer. ***(1)*** c. The second mutation has replaced "T" with "A". Explain the consequences in mRNA and the protein due to the mutation. ***(1)***	3
6.		3

a. Observe the image 'a' and select a set of individuals as an example to explain that the disease in this pedigree is not inherited in an X-linked recessive manner? Justify your answer. ***(1.5)***

b. Observe the image 'b' and point out those individuals whose pattern of inheritance for the trait (shown in darkened square/circle) is inconsistent with the pattern of autosomal dominant inheritance Justify your answer. ***(1.5)***

7.



Answer the following questions:

a. Observe the active site of an enzyme shown in the given figure and give the name of one amino acid which can be present at site A, B and C. Also justify the reason for your choice of amino acid. ***(1)***

b. The following table indicates the mutations of some amino acids in the active site given in the figure. Fill in your answer for each situation. ***(2)***

Situation	Will it affect the protein activity? Yes/No	Justify
If the site A is occupied by an amino acid having the side group as CH3		
If the site B is occupied by an amino acid having the side group as CH2-COOH		

3

8. In Drosophila two autosomal genes have the following alleles:
Grey body color(G) which is dominant over black body color (g)
Long wings (L) is dominant over vestigial (l).

Following cross was performed and the results are as shown.
True breeding parents: Grey body and long wings X Black body and vestigial wings
F2 numbers are
Grey body and Full wings-3100
Black body and Vestigial wings-3000

4

<table>
<tr><td></td><td>Grey body and Vestigial wings-500
Black body and Full wings-400
(i) State and justify if these two genes linked. (2)
(ii) Calculate the recombination frequency and map distance. (2)</td><td></td></tr>
<tr><td>9.</td><td>Replication, transcription and translation are important steps in gene expression and they are regulated. Protein synthesized on free ribosomes either remain in cytosol or are transported to the organelles. Protein synthesized on membrane bound or fixed ribosomes accumulates in the endoplasmic reticulum and then transported to other compartments.
a. What if ribosomal activity is not regulated? (1)
b. Design a sequence of 15 bp with introns and exons. Depict the alternative splicing with same sequence. Include the sequences of nascent protein synthesized with alternatively spliced genes. (2)
c. By separating transcription from translation the nucleus allows eukaryotes to regulate gene expression by the process that is unique to eukaryotes. What are these processes? Justify (1)</td><td>4</td></tr>
<tr><td>10.</td><td>In the Bacteria A, the position of the operator (O) and promoter (P) of the Lac operon was flipped. There was also a mutation in the promoter which made its binding to the RNA Polymerase unstable. Considering these conditions what would be the fate of the
i. Activator Protein
ii. Repressor
iii. Operon in the following conditions. Give proper reasoning.
<table>
<tr><td>P</td><td>LacI</td><td>O</td><td>P</td><td>Z</td><td>Y</td><td>A</td></tr>
</table>
a. Glucose is present and Lactose is absent
b. Both Glucose and Lactose are present
c. Both Glucose and Lactose are absent
d. Glucose is absent and Lactose is present
e. High cyclic AMP in cellular environment</td><td>5</td></tr>
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