

Mahindra University, Hyderabad
École Centrale School of Engineering
End-semester Regular Examination

UM

Program: B. Tech.

Year: 2022 (CSE, CM, AI) and 2021 (NT)

Subject: Introduction to Biology (BI1201)

Date: 06.06.2023

Time Duration: 3 Hours

Branch: CSE, CM, AI, NT

Semester: II (CSE, CM, AI) and IV (NT)

Start Time: 10:00 AM

Max. Marks: 60

Instructions:

- 1) Answer all questions from section I, II & III
- 2) Answer any 5 questions from section IV and draw diagrams wherever necessary

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Section-I. Choose the correct option.

15 x 1 = 15 marks

1. A new drug is developed which selectively cleaves hydrogen bonds in protein. Which level of protein structure is unaffected by the drug?
 - a) Quaternary structure
 - b) Tertiary structure
 - c) Secondary structure
 - d) Primary structure
2. How many mitotic divisions are required for a single cell to make 128 cells?
 - a) 7
 - b) 14
 - c) 28
 - d) 32
3. Which cellular structures are likely responsible for bacterial motility?
 - a) Endoplasmic reticulum
 - b) Golgi apparatus
 - c) Microtubules
 - d) Vacuole
4. Identify the cellular components that is NOT shared by a prokaryotic and eukaryotic cell
 - a) DNA as genetic material
 - b) Endoplasmic reticulum
 - c) Plasma membrane
 - d) Ribosomes
5. Which of the following are examples of in situ conservation?

I. Biosphere reserve	II. Seed banks	III. Zoological parks	IV. Sanctuary
a) II and III only	b) I and IV only	c) I only	d) III and IV only
6. An average adult human requires 2,200 kcal of energy per day. Suppose your diet provides an average of 2,300 kcal per day. How many hours per week would you have to run to burn off the extra calories? (Running 8mph = 979 kcal/hr)
 - a) 0.7 hr
 - b) 1.4 hr
 - c) 2.8 hr
 - d) 1 hr
7. Consuming high carbohydrate diet, leads to the accumulation of which among the following metabolites in the liver?
 - a) Glucose
 - b) Starch
 - c) Galactose
 - d) Glycogen

8. The sudden infant death syndrome (SIDS), an unexpected overnight death of healthy infants is attributed to defect in:
- a) Lactose metabolism
 - b) Fatty acid oxidation
 - c) Glucose oxidation
 - d) Melanin synthesis
9. Out of 32 ATP molecules produced per glucose molecule during cellular respiration
- a) 4 are produced during glycolysis and citric acid cycle and 28 during oxidative phosphorylation
 - b) 2 are produced outside mitochondria and 30 inside mitochondria
 - c) 2 during glycolysis and 30 during oxidative phosphorylation
 - d) Both a and b
10. Which of the following statement is incorrect about Turner's syndrome?
- a) People with Turner syndrome have $2n-1$ chromosome
 - b) Turner syndrome is an example of Trisomy
 - c) Turner syndrome is example of Monosomy
 - d) People with Turner syndrome have only one X chromosome
11. Which event occurs first in the replication of DNA?
- a) New nucleotides fit into place
 - b) New nucleotides are joined by DNA polymerase
 - c) Enzymes unzip DNA molecule, breaking hydrogen bonds between bases
 - d) Repair enzymes fix errors made during replication
12. Which of the following statement is incorrect about protein translation?
- a) In both prokaryotes and eukaryotes it takes place in the cytoplasm
 - b) There are 61 triplet codons that code for amino acids
 - c) Tryptophan is the first amino acid in a polypeptide chain
 - d) tRNA contains anticodons
13. The DNA chain acting as a template for RNA synthesis has the following order of bases: AGCTCGAATG. What will be the order of bases in mRNA?
- a) TCGAGCTTAC
 - b) AGCUCGAAUG
 - c) UCGAGCUUAC
 - d) AGCTCGAATG
14. Human genome contains thousands of genes which are expressed in the form of mRNA. What is the study of total RNA molecules in a cell?
- a) Transcriptomics
 - b) RNAomics
 - c) Genomics
 - d) Proteomics
15. Which of the following is not studied in metabolomics?
- a) Amino acids
 - b) Lipids
 - c) Sugars
 - d) RNA

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15 x 1 = 15 marks

1. Fats are hydrophobic in nature because the fatty acid tails of a fat molecule contain only nonpolar C-H bonds. **T**
2. Peroxisomes are recycling center of the cell as they break down damaged organelles and recycle biomolecules. **T**
3. Natural selection permits the adaptation of certain changes that benefit the survival of organisms and directs evolution. **T**
4. Vestigial organs are a result of evolution as these structures are often homologous to structures that function normally in other species. **T**
5. Lactose, a disaccharide sugar in milk is formed from glucose and galactose. The formula for both these monosaccharides is $C_6H_{12}O_6$, hence the formula of lactose is $C_{12}H_{24}O_{12}$. **F**
6. High blood sugar level is damaging to the body as the excess blood sugars gets stored as fats resulting in weight gain. **T**
7. Of the three main stages of cellular respiration, citric acid cycle takes place in the cell cytosol. **F**
8. Determination of enzyme activities from blood samples of patients is of great importance for the diagnosis of several diseases. **T**
9. Bacterial genomes cannot be altered by DNA technology to produce human proteins. **F**
10. RNA synthesis in transcription is regulated by specific RNA sequences termed initiators. **T**
11. During DNA replication, more RNA primers are used in lagging strand synthesis than in leading strand synthesis. **T**
12. Understanding only one part of a biological system in detail is enough to understand the complexity of biology. **F**
13. Gene expression regulation that occurs at DNA level is called transcriptional control. **T**
14. Mass spectrometry (MS) is an analytical technique that analyzes proteins based on their charge and mass. **T**
15. Genetic disorders such as hemophilia, sickle cell disease, and leukemia cannot be treated with human gene therapy. **F**

Section-III. Answer the following in ONE to THREE words

10 x 1 = 10 marks

1. In a given area, remains of animals that lived in the remote past are excavated for study. Which branch of science is this called?
2. The covalent bond that links monosaccharides to form polysaccharides is known as?
3. Which theory states that mitochondria were formerly small prokaryotes that began living within larger cells?
4. Cells actively transport Ca^{2+} out of the cell. Is calcium more concentrated inside or outside of the cell?
5. What is the region on an enzyme called, where the substrate fits specifically during a reaction?
6. What is the waste product produced during cellular respiration that is released during breathing?

7. During DNA replication, the synthesis of DNA on the lagging strand takes place in segments, these segments are called?
8. In prokaryotes, a cluster of genes are transcribed together to produce a single messenger RNA (mRNA) molecule. What is a cluster of genes called?
9. Eukaryotic genes are synthesized as pre-mRNA that are processed to form mature mRNA. Which parts of the pre-mRNA are removed during the maturation process?
10. Which technique is used for large scale analysis of proteins?

Section-IV. Answer any 5 questions.

5 x 4 = 20 marks

1. Answer the following questions: (1 x 4 = 4 marks)
 - a) Invasion of alien species leads to extinction of native species. Justify this with one example.
 - b) Homologous organs are indirect evidence of evolution. Justify this with one example.
 - c) Storage polysaccharide is the main form of energy storage in plants. Justify this with one example.
 - d) Proteins are crucial for transportation of various substances through blood. Justify this with one example.
2. A normal one month old baby has a history of vomiting and diarrhea that frequently occurred after breastfeeding. The urine gave a positive test for galactose sugars while the test was negative for glucose. The baby also showed signs of jaundice and cataract formation in eyes. What would be the diagnosis and discuss this condition in detail. What would be the best course of treatment for the condition?
3. What are the different types of enzyme inhibition? Explain the mechanism of each type with a specific example.
4. If in a specific ecosystem, 3000 calories of energy is consumed by the plants and 0.03 calorie of energy is consumed by the decomposers. Consider 90% energy is being consumed in each level. Calculate
 - a) How much energy is transferred from one trophic level to another (3 marks)
 - b) How many levels of consumers are present in-between the producer and decomposers (1 mark)
5. Before completion of cell division, the DNA in the cell needs to be doubled and distributed equally between the resulting daughter cells. Describe the process by which DNA is replicated.
6. Why is the human body considered a "Network of Networks"? Describe in your own words.
7. Describe what is meant with the term "genomics"? Describe how the whole genome data can be generated.