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Mahindra University, Hyderabad
École Centrale School of Engineering
End Term Examination

Program: B. Tech. **Branch: CSE, CM, AI** **Year: First (CSE, CM, AI)**

Semester: II (CSE/ CM/ AI) **Subject: Introduction to Biology (BI1201)**

Date: 29-05-2024 **Start Time: 10:00 AM**

Time Duration: 3:00 Hours **Max. Marks: 60**

Instructions:

1) Answer all questions
2) Answers must be to the point
3) Draw diagrams wherever necessary

Section-I. Choose the right option (10 x 1= 10 marks)

Note: Only write the question number followed by the chosen option (e.g. 1-A)

1. Identify the option, where all the columns are matched incorrectly:

A	Indirect value of biodiversity	Aesthetic values	Ecotourism
B	Direct value of biodiversity	Consumptive use values	Antibiotics
C	Indirect value of biodiversity	Environmental values	Oxygen from cyanobacteria
D	Direct value of biodiversity	Productive use values	Live and let live

2. Which of the following organelles are present in both prokaryotic and eukaryotic cells.

I. Ribosomes
II. Rough endoplasmic reticulum
III. Nucleolus
IV. Cell membrane

A. I and III only
B. I and IV only
C. II and III only
D. IV only

3. Okazaki fragments are used to elongate
   A. The lagging strand toward the replication fork
   B. Both strands in both directions
   C. The leading strand away from the replication fork
   D. The lagging strand away from the replication fork

4. If both genotype and phenotype show the same ratios of 1:2:1 in the F2 generation,
   A. It shows incomplete dominance in monohybrid cross
   B. Complete dominance in monohybrid cross
   C. Dihybrid cross
   D. Co-dominance

5. Translation begins with which of the following processes?
   A. Recognition of an anticodon
   B. Binding of mRNA to ribosome
   C. Aminoacylation of tRNA
   D. Aminoacylation of mRNA

6. The end products of aerobic respiration are as follows:
   A. Sugar and oxygen
   B. Water and energy
   C. Carbon dioxide, water, and energy
   D. Carbon dioxide and energy

7. Which of the following best describes the metabolic disease albinism
   A. A condition characterized by excessive melanin production
   B. A disorder resulting from an absence of pigment in the skin, hair, and eyes
   C. A metabolic disease associated with high levels of glucose in the blood
   D. A condition that primarily affects bone density and calcium levels

8. How does systems biology differ from traditional biology approaches?
   A. Systems biology focuses on isolated biochemical pathways without considering the entire system.
   B. Systems biology integrates data from multiple levels (genes, proteins, metabolites) to understand the system as a whole.
   C. Traditional biology uses computational models exclusively, while systems biology does not.
   D. Systems biology relies solely on experimental data without computational analysis.

9. Which of the following best describes the 'omics' approach in systems biology?
   A. Studying the structure of a single gene
   B. Examining the behavior of a single protein
   C. Measuring the pH of various cellular compartments
   D. Analyzing the complete set of molecules within a biological system, such as genomics, proteomics, and metabolomics

10. 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

Section-II. State if the following statements are TRUE or FALSE. (10 x 1= 10 marks)

Note: Only write the question number followed by either "true" or "false" (e.g. 1-True)

1. According to "Modern synthetic theory", geographical isolation of species leads to generation of variations and emergence of new species.
2. The functional structure of a proteins containing a single polypeptide chain is its quaternary structure.
3. A DNA sequence is read by an RNA polymerase which creates complementary antiparallel RNA strand is regarded as Primary Transcript.
4. Cross between two recessive homozygotes is called test cross.
5. AGG is known as the start codon.
6. Galactose is the metabolite that gets accumulated in the liver upon consumption of high carbohydrate diet.
7. Enzymes measured in liver function tests (LFTs) have significant diagnostic potential for assessing liver health and detecting liver-related diseases.
8. Proteomics focuses on the study of small molecules, such as metabolites, within a cell, tissue, or organism.
9. Transcriptomics can be used to measure the expression levels of genes under different environmental conditions or treatments.
10. Understanding only a part of a biological system in detail is enough to understand the complexity of biology.

Section-III. Match the following (10 x 1= 10 marks)

Note: Only write the question number and matching letter (e.g. 1-D)

1. Smooth Endoplasmic Reticulum	A. Genomics
2. Intermediate filaments	B. Autosomal recessive manner inheritance
3. Ex-situ conservation	C. Steroid synthesis
4. Stop codon	D. Three leaf clover structure
5. tRNA	E. Predictive model
6. Von Gierke's disease	F. Anchors nucleus
7. Citric acid cycle	G. UAG
8. RNA-seq	H. Transcriptomics
9. Study of complete DNA sequence	I. Seed banks
10. Data integration	J. Carbon dioxide production

Section-IV. Answer the following in ONE to THREE words only (10 x 1= 10 marks)

1. The sodium concentration in a cell is 10 times less than the concentration in the surrounding fluid. The cell moves sodium out of the cell by which mode of transportation?
2. Mention one unique property of water that occurs due to hydrogen bonding between its molecules.
3. The fragments of DNA are joined together by which ~~of the following~~ enzyme$?
4. Several possible forms of a gene is called?
5. Which principle was not introduced by Mendel?
6. Out of 32 ATP molecules produced per glucose molecule during cellular respiration, how many ATPs are produced inside mitochondria?
7. Enzymes are composed of proteins, yet many enzymes also need non-protein assistants known as?
8. What term refers to the comprehensive analysis of small molecules within cells, tissues, or organisms?
9. Which technique is commonly used to analyze proteins and their interactions?
10. Which technology is commonly used for high-throughput DNA sequencing?

Section-V. Answer ALL of the following (4 x 5= 20 marks)

1. Answer the following questions.
   a) Genetic diversity occurs within species, where a single species shows high diversity at the genetic level. Justify this with one example. (1 Mark)
   b) Vestigial organs are indirect evidence of evolution. Justify this with one example. (1 Mark)
   c) Polysaccharides, provide structural support to plant cells, enabling them to maintain their shape and resist external forces. Justify this with one example. (1.5 Mark)
   d) Proteins are crucial for transportation of various substance through blood. Justify this with one example. (1.5 Mark)

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2. How would you construct a Punnett diagram to illustrate the inheritance patterns of two traits, considering the law of independent assortment, for a cross between true-breeding plants with yellow round seeds (YYRR) and green wrinkled seeds (yyrr), leading to the formation of dihybrid F1 plants and subsequent self-pollination to produce the F2 generation?

3. What is the difference between non-competitive and feedback inhibition of enzymes? Provide an example elucidating each form of enzyme inhibition.

4. What does the term "genomics" mean? Explain the process of generating whole genome data.