



**QUESTION BANK WITH MARKS DISTRIBUTION**

**Module 1**

**CELL BASIC UNIT OF LIFE**

**Question**

Mention the significance of understanding cell biology. Discuss the potential interdisciplinary applications of this knowledge in fields such as bioinformatics, computational biology, and medical technology.

CO1, RBTL 3, 10 Marks

**Marks Distribution**

Introduction and Context (2 marks): Providing context and highlighting the importance of understanding cell biology for a computer science student.

Discussion of Key Steps in Life Formation (6 marks): Elaborating on the eight key steps involved in life formation, demonstrating a comprehensive understanding of cell biology.

Interdisciplinary Applications (2 marks): Discussing potential interdisciplinary applications in bioinformatics, computational biology, and medical technology.

**Question**

Analyze the significance of cell structures in carrying out specific cellular functions, and how this understanding can be applied to design innovative solutions for real-world bioengineering challenges.

CO2, RBTL 3, 10 Marks

**Mark Distribution**

Introduction to Cell Structure (2 marks):

1 mark for clearly stating cells as basic units of life and mentioning the classification of prokaryotic and eukaryotic cells.

1 mark for highlighting the structural differences between prokaryotic and eukaryotic cells, with examples.

Cell Components (3 marks):

1 mark for describing the function of the cell membrane.

1 mark for explaining the role of the nucleus in eukaryotic cells.

1 mark for mentioning the function of the cytoplasm and defining organelles.

Schematic Images (2 marks):

1 mark for providing a clear schematic image of a prokaryotic cell.

1 mark for providing a clear schematic image of a eukaryotic cell.

Functions of a Cell (3 marks):

1 mark for each correctly explained cellular function, including cellular respiration, photosynthesis (in plant cells), DNA replication and cell division, and protein synthesis.

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**Question**

How do stem cell applications advance healthcare? Discuss challenges and ethical considerations, offering critical insights into their potential impacts on medical practices and society.

CO4, RBTL 3, 10 Marks

**Marks Distribution**

Importance of stem cells 1 mark

Types of stem cells 2 marks

Applications of stem cells (Any 5) 5 marks

Challenges & Ethical considerations 2 mark

**Question**

What are the primary functions of carbohydrates in living organisms, and can you provide examples of their different properties that contribute to these functions?

CO1, RBTL 2, 05 Marks

**Marks Distribution**

Properties of Carbohydrates (Any 2) 2 Marks

Functions of Carbohydrates (Any 4) 3 Marks

**Question**

What is the primary function of nucleic acids in cellular processes, and how do they contribute to the transmission of genetic information? Additionally, discuss one specific role of nucleic acids in cellular regulation.

CO1, RBTL 2, 05 Marks

**Marks Distribution**

Properties of Nucleic Acids (Any 5) 2 ½ Marks

Functions of Nucleic Acids (Any 5) 2 ½ Marks

**Question**

How do proteins, through their diverse functions such as enzymatic activity, structural support, and hormonal regulation, contribute to the overall health and functioning of living organisms?

CO1, RBTL 2, 05 Marks

**Marks Distribution**

Properties of Proteins (Any 5) 2 Marks

Functions of Proteins with Examples (Any 5) 3 Marks

**Question**

How do lipids contribute to the structural integrity of cell membranes, and what role do they play

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in energy storage and metabolic regulation within living organisms?

CO1, RBTL 2, 05 Marks

Marks Distribution

Properties of Lipids (Any 5) 2 Marks

Functions of Lipids with Examples (Any 5) 3 Marks

Question

Explain the properties and functions of enzymes with suitable examples.

CO1, RBTL 2, 05 Marks

Marks Distribution

Properties (Any 5) 3 Marks

Functions with example (Any 5) 2 Marks

Question

Discuss about the properties and functions Vitamins with its supplies.

CO1, RBTL 2, 05 Marks

Marks Distribution

Properties of Vitamins (Any 5) 2 Marks

Functions of Vitamins with its Supplies (Any 5) 3 Marks

Question

Describe the specific properties and functions of hormones.

CO1, RBTL 2, 05 Marks

Marks Distribution

Properties of Hormones (Any 5) 2 Marks

Functions of Hormones with Examples (Any 5) 3 Marks

**Module 2**

**APPLICATION OF BIOMOLECULES**

Question

Explain how carbohydrates are utilized in the production of cellulose-based water filters. Discuss the advantages and limitations of this application.

CO 1, RBTL 3, 10 Marks

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Introduction to carbohydrates and cellulose (2 marks)

Process of production of cellulose-based water filters (3 marks)

Advantages of using cellulose-based water filters (3 marks)

Limitations and challenges (2 marks)

Question

Describe the role of Polyhydroxyalkanoates (PHA) and Polylactic acid (PLA) in bioplastics production. Compare their properties and applications.

CO 2, RBTL 3, 10 Marks

Marks Distribution:

Introduction to PHA and PLA (2 marks)

Production process of PHA and PLA (3 marks)

Comparison of properties (3 marks)

Applications in bioplastics (2 marks)

Question

Discuss the application of nucleic acids in vaccine development and diagnosis. Provide examples to support your explanation.

CO 1, RBTL 3, 10 Marks

Marks Distribution:

Introduction to nucleic acids (2 marks)

Role in vaccine development (4 marks)

Role in diagnosis (2 marks)

Examples (2 marks)

Question

Analyze the significance of proteins in food production. Highlight the industrial processes where proteins are crucial.

CO 1, RBTL 3, 10 Marks

Marks Distribution:

Introduction to proteins (2 marks)

Role in food production (3 marks)

Key industrial processes involving proteins (3 marks)

Significance and benefits (2 marks)

Question

Explain how lipids are utilized in the production of biodiesel and detergents. Discuss the

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economic and environmental impact of these applications.

CO 4, RBTL 3, 10 Marks

Marks Distribution:

Introduction to lipids (2 marks)

Production of biodiesel from lipids (3 marks)

Production of detergents from lipids (2 marks)

Economic and environmental impact (3 marks)

Question

Discuss the application of enzymes in biosensor fabrication. Describe the principles behind enzyme-based biosensors.

CO 3, RBTL 3, 10 Marks

Marks Distribution:

Introduction to enzymes (2 marks)

Principles of enzyme-based biosensors (4 marks)

Applications of enzyme-based biosensors (3 marks)

Future prospects (1 mark)

Question

Illustrate the use of enzymes in food processing. Highlight specific enzymes and their roles.

CO 1, RBTL 3, 10 Marks

Marks Distribution:

Introduction to enzymes in food processing (2 marks)

Specific enzymes used (3 marks)

Roles of these enzymes (3 marks)

Benefits in food processing (2 marks)

Question

Describe the formulation of detergents using enzymes. Discuss the advantages and any potential drawbacks.

CO 4, RBTL 3, 10 Marks

Marks Distribution:

Introduction to enzyme-based detergents (2 marks)

Formulation process (4 marks)

Advantages (2 marks)

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Potential drawbacks (2 marks)

Question

Explain the application of enzymes in textile processing. Provide examples of specific enzymes and their functions.

CO 1, RBTL 3, 10 Marks

Marks Distribution:

Introduction to enzymes in textile processing (2 marks)

Specific enzymes used (3 marks)

Functions of these enzymes (3 marks)

Examples (2 marks)

**Module 3**

**ADAPTATION OF ANATOMICAL PRINCIPLES FOR BIOENGINEERING DESIGN**

Question

Explain how the brain's structure and functioning can be compared to a computer's CPU, and evaluate how these principles can be applied in designing neural networks in artificial intelligence.

CO3, RBTL3, 10 Marks

Marks Distribution:

Comparison of brain structure to CPU (3 Marks)

Explanation of brain functioning and CPU operations (3 Marks)

Application of these principles in neural network design (4 Marks)

Question

Compare the architecture of the human eye with a digital camera, focusing on the roles of rod and cone cells, and discuss the implications for developing advanced imaging systems.

CO1, RBTL3, 10 Marks

Marks Distribution:

Comparison of eye and camera architecture (4 Marks)

Role of rod and cone cells in vision (3 Marks)

Implications for imaging system development (3 Marks)

Question

Describe the mechanisms by which the heart functions as a pump, and evaluate how these

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mechanisms have inspired the design of artificial heart devices.

CO2, RBTL3, 10 Marks

Marks Distribution:

Description of heart's pumping mechanisms (4 Marks)

Evaluation of how these mechanisms are applied in artificial heart design (6 Marks)

Question

Explain how the lungs purify the blood, and analyze how this biological principle has been adapted in the design of artificial respiratory systems.

CO4, RBTL3, 10 Marks

Marks Distribution:

Explanation of lung function in blood purification (4 Marks)

Analysis of adaptation in artificial respiratory systems (6 Marks)

Question

Discuss the process by which kidneys filter waste from the blood, and evaluate how this process has influenced the development of dialysis machines.

CO1, RBTL3, 10 Marks

Marks Distribution:

Discussion of kidney filtration process (4 Marks)

Evaluation of its influence on dialysis machine development (6 Marks)

Question

Analyze the analogy of the brain as a CPU in the context of parallel processing, and discuss its impact on the development of parallel computing systems.

CO3, RBTL3, 10 Marks

Marks Distribution:

Analysis of brain as a CPU and parallel processing (5 Marks)

Discussion of impact on parallel computing systems (5 Marks)

Question

Describe the process of image formation in the human eye, and evaluate how understanding this process has contributed to advancements in camera sensor technology.

CO2, RBTL3, 10 Marks

Marks Distribution:

Description of image formation in the eye (4 Marks)

Evaluation of contributions to camera sensor technology (6 Marks)

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**Question**

Compare the heart's pumping action to that of a mechanical pump, and discuss the challenges and innovations in developing artificial heart valves.

CO4, RBTL3, 10 Marks

**Marks Distribution:**

Comparison of heart and mechanical pump (4 Marks)

Discussion of challenges and innovations in artificial heart valves (6 Marks)

**Module 4**

**NATURE-BIOINSPIRED MATERIALS AND MECHANISMS**

**Question**

Explain the mechanism of echolocation used by bats and dolphins, and evaluate how these principles have been applied in the development of sonar and navigation systems.

CO3, RBTL3, 10 Marks

**Marks Distribution:**

Explanation of echolocation mechanism (3 Marks)

Comparison between echolocation in bats and dolphins (2 Marks)

Evaluation of application in sonar systems (3 Marks)

Evaluation of application in navigation systems (2 Marks)

**Question**

Describe the principles of bird flight, and analyze how these principles have influenced the design of modern aircraft.

CO1, RBTL3, 10 Marks

**Marks Distribution:**

Description of principles of bird flight (3 Marks)

Explanation of aerodynamic features in birds (2 Marks)

Analysis of how bird flight principles are applied in aircraft design (3 Marks)

Specific examples of aircraft features inspired by birds (2 Marks)

**Question**

Explain the process of photosynthesis in plants, and discuss how understanding this process has led to advancements in solar energy technologies.

CO4, RBTL3, 10 Marks

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Marks Distribution:

Explanation of photosynthesis process (4 Marks)

Discussion of key steps and components involved (2 Marks)

Analysis of how photosynthesis principles are applied in solar energy technologies (2 Marks)

Examples of advancements in solar energy inspired by photosynthesis (2 Marks)

Question

Describe the lotus leaf effect and its self-cleaning properties, and evaluate how this phenomenon has been utilized in developing water-repellent materials.

CO2, RBTL3, 10 Marks

Marks Distribution:

Description of lotus leaf effect and self-cleaning properties (3 Marks)

Explanation of the biological mechanism behind the effect (2 Marks)

Evaluation of applications in water-repellent materials (3 Marks)

Examples of specific products utilizing this effect (2 Marks)

Question

Discuss how the structure of plant burrs inspired the invention of Velcro, and analyze the key factors that made this biomimetic innovation successful.

CO1, RBTL3, 10 Marks

Marks Distribution:

Discussion of plant burr structure (3 Marks)

Explanation of the inspiration process for Velcro (2 Marks)

Analysis of the key factors in the success of Velcro (3 Marks)

Examples of Velcro applications (2 Marks)

Question

Explain how the structure of shark skin reduces drag, and evaluate how these properties have been applied to improve swimwear and ship hull designs.

CO3, RBTL3, 10 Marks

Marks Distribution:

Explanation of shark skin structure and drag reduction (4 Marks)

Evaluation of application in swimwear design (3 Marks)

Evaluation of application in ship hull design (3 Marks)

Question

Describe how the shape of the kingfisher beak reduces noise and water resistance, and

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discuss its application in designing high-speed trains.

CO4, RBTL3, 10 Marks

Marks Distribution:

Description of kingfisher beak shape and its properties (4 Marks)

Explanation of how these properties reduce noise and water resistance (2 Marks)

Discussion of application in high-speed train design (4 Marks)

Question

Compare hemoglobin-based oxygen carriers (HBOCs) and perfluorocarbons (PFCs) as human blood substitutes, and analyze their potential impact on medical treatments.

CO2, RBTL3, 10 Marks

Marks Distribution:

Comparison of HBOCs and PFCs mechanisms (3 Marks)

Discussion of advantages and disadvantages of each type (3 Marks)

Analysis of potential impact on medical treatments (4 Marks)

**Module 5**

**TRENDS IN BIOENGINEERING**

Question

Describe how the muscular and skeletal systems serve as natural scaffolds in the human body, and evaluate their potential applications in tissue engineering.

CO1, RBTL3, 10 Marks

Marks Distribution:

Description of muscular system as scaffolds (3 Marks)

Description of skeletal system as scaffolds (3 Marks)

Evaluation of applications in tissue engineering (4 Marks)

Question

Explain the role of scaffolds in tissue engineering and analyze the criteria for selecting materials for scaffolds.

CO2, RBTL3, 10 Marks

Marks Distribution:

Explanation of the role of scaffolds in tissue engineering (4 Marks)

Analysis of criteria for selecting scaffold materials (6 Marks)

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**Question**

Describe the basic principles of bioprinting and evaluate the impact of different bioprinting materials on tissue engineering outcomes.

CO2, RBTL3, 10 Marks

**Marks Distribution:**

Description of bioprinting principles (4 Marks)

Evaluation of different bioprinting materials (6 Marks)

**Question**

Explain the working principles of the electrical tongue and electrical nose, and analyze their significance in food quality control.

CO1, RBTL3, 10 Marks

**Marks Distribution:**

Explanation of the electrical tongue (3 Marks)

Explanation of the electrical nose (3 Marks)

Analysis of significance in food quality control (4 Marks)

**Question**

Describe the concept of DNA origami and its role in biocomputing, and evaluate potential applications in computational biology.

CO2, RBTL3, 10 Marks

**Marks Distribution:**

Description of DNA origami (4 Marks)

Explanation of role in biocomputing (3 Marks)

Evaluation of potential applications in computational biology (3 Marks)

**Question**

Discuss how bioimaging techniques combined with artificial intelligence can enhance disease diagnosis, providing examples of their successful applications.

CO4, RBTL3, 10 Marks

**Marks Distribution:**

Discussion on bioimaging techniques (3 Marks)

Explanation of how AI enhances disease diagnosis (3 Marks)

Examples of successful applications (4 Marks)

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Question

Explain the concept of bioconcrete and its self-healing properties, and evaluate its potential impact on the construction industry.

CO3, RBTL3, 10 Marks

Marks Distribution:

Explanation of bioconcrete (3 Marks)

Description of self-healing properties (3 Marks)

Evaluation of potential impact on the construction industry (4 Marks)

Question

Describe the processes of bioremediation and biomining, and analyze their environmental benefits compared to traditional methods.

CO4, RBTL3, 10 Marks

Marks Distribution:

Description of bioremediation (3 Marks)

Description of biomining (3 Marks)

Analysis of environmental benefits compared to traditional methods (4 Marks)