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NOIDA INSTITUTE OF ENGINEERING AND TECHNOLOGY, GREATER NOIDA
(An Autonomous Institute Affiliated to AKTU, Lucknow)

B.Tech

SEM: II - THEORY EXAMINATION (2025- 2026)

Subject: Fundamentals of Bioengineering

Time: 2 Hours

Max. Marks: 50

General Instructions:

IMP: Verify that you have received the question paper with the correct course, code, branch etc.

1. This Question paper comprises of **three Sections -A, B, & C**. It consists of Multiple Choice Questions (MCQ's) & Subjective type questions.

2. Maximum marks for each question are indicated on right -hand side of each question.

3. Illustrate your answers with neat sketches wherever necessary.

4. Assume suitable data if necessary.

5. Preferably, write the answers in sequential order.

6. No sheet should be left blank. Any written material after a blank sheet will not be evaluated/checked.

SECTION-A

15

1. Attempt all parts:-

- | | | |
|-------|--|---|
| (1.1) | Which ancient practice forms the foundation of bioengineering? (CO1, K1) | 1 |
| | (a) Weaving | |
| | (b) Fermentation | |
| | (c) Pottery | |
| | (d) Architecture | |
| (1.2) | ATP is an example of (CO2, K1) | 1 |
| | (a) Mechanical energy | |
| | (b) Chemical energy | |
| | (c) Thermal energy | |
| | (d) Electrical energy | |
| (1.3) | Biomechanics is best defined as the study of (CO3, K1) | 1 |
| | (a) Chemical processes in the body | |
| | (b) Mechanical aspects of living organisms | |
| | (c) Electrical signals in neurons | |
| | (d) Genetic inheritance | |
| (1.4) | EEG is used to measure what? (CO4, K1) | 1 |
| | (a) Muscle activity | |
| | (b) Brain activity | |
| | (c) Heart activity | |
| | (d) Blood pressure | |
| (1.5) | In which phase do microbial cells not multiply? (CO5, K1) | 1 |

- (a) Log phase
- (b) Stationary phase
- (c) Lag phase
- (d) Death phase

2. Attempt all parts:-

- | | | |
|-------|---|---|
| (2.1) | Define bioremediation and describe how it helps in environmental cleanup (CO1, K2) | 2 |
| (2.2) | Explain the concept of mass flow rate. (CO2, K2) | 2 |
| (2.3) | State Newton's third law of motion and explain it with a suitable example. (CO3, K2) | 2 |
| (2.4) | Define pulse oximetry and explain its clinical significance. (CO4, K2) | 2 |
| (2.5) | Define the viable cell count method and explain how it is used to measure microbial growth. (CO5, K2) | 2 |

SECTION-B

15

Answer any one of the following:-

- | | | |
|-------|---|---|
| (3.1) | Explain the future trends in bioengineering and their potential impact. (CO1, K2) | 3 |
| (3.2) | Define biomaterials and classify them with suitable examples. (CO1, K2) | 3 |

Answer any one of the following:-

- | | | |
|-------|--|---|
| (3.3) | Explain components of mass balance (input, output, accumulation, generation) with biological examples. (CO2, K2) | 3 |
| (3.4) | Explain the concept of coupled biochemical reactions and describe their biological significance. (CO2, K2) | 3 |

Answer any one of the following:-

- | | | |
|-------|--|---|
| (3.5) | Explain work, power, and energy in biomechanics with examples, and discuss their interrelationships and applications. (CO3, K2) | 3 |
| (3.6) | Explain the stress-strain behavior of cartilage, and discuss its mechanical role in joints and relevance in degenerative conditions. (CO3, K2) | 3 |

Answer any one of the following:-

- | | | |
|-------|--|---|
| (3.7) | Explain advantages and limitations of biosensors in medical applications. (CO4, K2) | 3 |
| (3.8) | Explain medical imaging techniques such as X-ray, CT, MRI, and ultrasound with examples. (CO4, K2) | 3 |

Answer any one of the following:-

- | | | |
|--------|--|---|
| (3.9) | Explain the concept of specific growth rate in microorganisms. (CO5, K2) | 3 |
| (3.10) | Explain the metabolic role of carbohydrates, proteins, and lipids. (CO5, K2) | 3 |

SECTION-C

20

4. Answer any one of the following:-

- | | | |
|-------|---|---|
| (4.1) | Define regenerative medicine and personalized medicine and give their benefits. (CO1, K2) | 4 |
| (4.2) | Define synthetic biology and biosensors. How these subjects have changed the | 4 |

shape of modern day research? (CO1, K2)

5. Answer any one of the following:-

- | | | |
|-------|---|---|
| (5.1) | Explain internal energy and describe its forms and storage in a system. (CO2, K2) | 4 |
| (5.2) | Explain diffusion coefficient and discuss its significance in biological systems. (CO2, K2) | 4 |

6. Answer any one of the following:-

- | | | |
|-------|--|---|
| (6.1) | Define center of mass and explain its role in maintaining posture and balance during activities. (CO3, K2) | 4 |
| (6.2) | Define work, power, and energy and illustrate each with examples from human movement. (CO3, K2) | 4 |

7. Answer any one of the following:-

- | | | |
|-------|---|---|
| (7.1) | Define MRI and explain its components and working principle. (CO4, K2) | 4 |
| (7.2) | Define signal conditioning and explain its stages and importance in biomedical systems. (CO4, K2) | 4 |

8. Answer any one of the following:-

- | | | |
|-------|--|---|
| (8.1) | Explain the four phases of the microbial growth curve in detail with their significance. (CO5, K2) | 4 |
| (8.2) | Explain the need for bioreactors in large-scale bioprocessing with examples. (CO5, K2) | 4 |