

## **Selected Topics and Sample Questions for the Diploma Examination in Biotechnology**

### **Selected Topics from the Biotechnology Program for the Engineering Diploma Examination:**

1. **Molecular Biology and Genetics:** Understanding the basic concepts of DNA, RNA, gene expression, and genetic engineering.
2. **Biochemistry:** Focusing on chemical processes and substances in living organisms.
3. **Cell Biology:** Study of the structure and function of cells, tissues, cell components, and cellular processes.
4. **Microbiology:** Study of microorganisms, including bacteria, viruses, fungi, and protozoa, and their role in biotechnology.
5. **Bioprocess Engineering:** Principles and techniques of bioprocesses, including fermentation and bioseparation technology.
6. **Bioinformatics:** Introduction to computational biology, database management, and analysis of biological data.
7. **Immunology:** The immune system, antibody engineering, and applications in biotechnology.
8. **Plant and Animal Biotechnology:** Genetic manipulation in plants and animals to improve traits and productivity.
9. **Applications of biotechnology in medicine,** including tissue engineering and biomaterials.
10. **Environmental Biotechnology:** Application of biotechnological methods for environmental protection, waste management, and pollution control.
11. **Biostatistics:** Understanding statistical methods of analysis and interpretation of biological data.
12. **Biophysics:** Study of the physical principles underlying biological systems and processes.
13. **Biochemical Engineering:** Application of chemical engineering principles in biological systems.
14. **Tissue Engineering:** Understanding the principles of tissue growth and regeneration for medical applications.

15. Environmental Biotechnology: Application of biotechnological methods for environmental reclamation and sustainable development.
16. Industrial Biotechnology: Use of biotechnology in industrial processes, including fermentation and enzyme technology.
17. Bioethical and Regulatory Aspects: Understanding ethical, legal, and regulatory issues in biotechnology.
18. Genetic Engineering Techniques: Understanding methods of gene cloning, transgenic organisms, and CRISPR technology.
19. Biological Data Analysis: Focusing on sequencing techniques and analysis of genomic, proteomic, and metabolomic data, studying structure, function, and mapping of genomes and proteomes.
20. Nanobiotechnology: Studying applications of nanotechnology in biomedicine, drug delivery, and diagnostics.
21. Biomaterials and Biofabrication: Understanding the development and applications of materials for medical or biotechnological purposes.
22. Enzyme Technology: Application of enzyme engineering in industrial processes.
23. Immunotechniques: Study of methods and applications of immunological tests, ELISA, and flow cytometry in biotechnology.
24. Metabolic Engineering: Understanding the modification of metabolic pathways to improve production of desired substances.
25. Stem Cell Technology: Focusing on applications and ethical considerations of stem cell research.
26. Biobusiness and Biotechnology Enterprise Management: Covering business and entrepreneurial aspects of biotechnology.

### **Sample Questions for the Diploma Examination – Concerning the Program:**

1. Define biotechnology and its historical development.
2. Explain the structure and function of DNA and RNA.
3. Describe the process of protein synthesis.
4. What is molecular cloning?
5. Explain the principles of PCR and its applications.
6. Describe the process of gel electrophoresis.

7. What are restriction enzymes and how are they used in genetic engineering?
8. Discuss the role of biotechnology in agriculture.
9. Explain techniques used in the genetic modification of crop plants.
10. What are the ethical issues in genetic engineering?
11. Describe the process of fermentation and its industrial applications.
12. Explain the role of enzymes in biotechnological processes.
13. What is gene therapy and how does it work?
14. Discuss the application of biotechnology in medicine, including vaccine production.
15. Explain the role of bioreactors in biotechnological processes.
16. What is the significance of stem cell research in biotechnology?
17. Discuss ecological applications of biotechnology.
18. Explain the process of DNA sequencing.
19. Describe the principles of chromatography used in biotechnology.
20. What is bioinformatics and its role in biotechnology?
21. Discuss the applications of nanobiotechnology.
22. Explain the principles of immunological tests in biotechnology.
23. Describe the applications of tissue engineering in animals or plants.
24. What are biosensors and how are they used?
25. Discuss the role of biotechnology in food processing and preservation.
26. Explain the concept of synthetic biology.
27. Discuss the biotechnological applications of CRISPR-Cas9.
28. What is metabolic engineering and its significance?
29. Explain the role of biotechnology in the production and protection of animals or plants.
30. Describe a selected process of protein engineering application.
31. Discuss the importance of genomic, proteomic, or metabolomic research in biotechnology.

32. Explain the principles of cell and tissue culture.
33. What are monoclonal antibodies and how are they produced?
34. Discuss the role of biotechnology in waste management.
35. Explain the concept of bioremediation.
36. Discuss the principles of genomics and its applications.
37. What is pharmacogenomics?
38. Explain the process of drug discovery and development in biotechnology.
39. Discuss biotechnological approaches to disease diagnostics.
40. What is bioethics and why is it important in biotechnology?
41. Indicate the uses of microorganisms in biotechnology.
42. Discuss the impact of biotechnology on biodiversity.
43. Describe the role of biotechnology in animal breeding.
44. What is the significance of biostatistics in biotechnological research?
45. Explain the concept of transgenic organisms and their applications.
46. Discuss the industrial production of antibiotics using biotechnological methods.
47. Explain the principles and applications of flow cytometry.
48. What challenges are associated with scaling up biotechnological processes?
49. Discuss the role of biotechnology in nutrition and health.
50. Open question from the examination board chair.

### **Sample Questions for the Diploma Examination – Concerning the Diploma Thesis:**

1. Describe the practical applications of your research results.
2. What key safety protocols were followed during laboratory experiments?
3. Explain the statistical methods used to analyze the data in your research, and justify your choice.
4. Discuss any innovative techniques or equipment used in your experiments. How did they affect your results?

5. Identify and explain any unexpected results of your experiments. Was it necessary to adjust your research (concepts, methods, etc.)?
6. Describe the process of sample collection and preparation in your research. Why was this method chosen?
7. Explain the controls used in your experiments. Why were they necessary and how did they affect the results?
8. Discuss ethical considerations relevant to your research. How were they taken into account in the experimental design?
9. How was repeatability and transparency of experimental methods ensured?
10. Describe any challenges you encountered during the experimental phase of your research and how you overcame them.