



Department of Genetic Engineering and Biotechnology
Faculty of Health and Life Sciences
B. Sc. (Hons.) in Genetic Engineering and Biotechnology
Final Examination Summer 2026

Course Code: 0512-2201

Course Title: Biofertilizer and Renewable Energy

Level and Term: L-2, T-2
Time: 02 Hours

Section 251 (A+B)

Course Teacher's Initial: KMH + MAR
Total Marks: 40

Answer the following questions:

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| 1. (a) Compare the organization and regulation of <i>nif</i> genes in <i>Klebsiella</i> , <i>Rhizobium</i> , and <i>Anabaena</i> , highlighting the key regulatory proteins and mechanisms of oxygen sensing in each system. [CLO2, PLO2, C4] | 4.0 |
| (b) Classify the major biofertilizer microorganisms according to their principal functions and briefly outline the general workflow for their isolation and identification. [CLO1, PLO2, C4] | 4.0 |
| 2. (a) Illustrate diagrammatically the major steps involved in the mass production of <i>Rhizobium</i> . [CLO2, PLO2, C2] | 4.0 |
| (b) List the <u>major functions</u> of <i>Azotobacter</i> and illustrate its multifunctional roles with a suitable diagram. [CLO3, PLO2, C1] | 4.0 |
| 3. (a) Describe the major types of <i>Azospirillum</i> inoculants and their methods of application, and briefly discuss the crop responses following inoculation. [CLO3, PLO2, C2] | 4.0 |
| (b) Compare <i>Rhizobium</i> and <i>Frankia</i> with respect to their major biological characteristics, and <u>illustrate the principal infection pathways of <i>Frankia</i> in actinorhizal plants</u> . [CLO2, PLO2, C4] | 4.0 |
| 4. (a) Illustrate the key benefits of mycorrhizal fungi and discuss <u>the major methods of mycorrhizal inoculum production</u> . [CLO3, PLO2, C5] | 4.0 |
| (b) Define <i>Azolla</i> and composting, and state their major benefits. Illustrate the mechanism of phosphate solubilization. [CLO3, PLO2, C1] | 4.0 |
| 5. (a) Describe the major types and <u>methods of application of <i>Rhizobium</i> inoculants</u> , and briefly explain the factors that determine their effectiveness under field condition. [CLO2, PLO2, C4] | 4.0 |
| (b) Write short notes on the followings: (i) <u>Symbiotic Nitrogen Fixation</u> (ii). Functions of <i>Azospirillum</i> [CLO3, PLO2, C2] | 4.0 |