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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 **Section 251 (A+B)** **Course Teacher's Initial: KMH + MAR**
Time: 02 Hours **Total Marks: 40**

Answer the following questions:

			Marks
1.	(a)	Compare the organization and regulation of *nif* genes in *Klebsiella*, *Rhizobium*, and *Anabaena*, 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 *Rhizobium*.	[CLO2, PLO2, C2] 4.0
	(b)	List the major functions of *Azotobacter* and illustrate its multifunctional roles with a suitable diagram.	[CLO3, PLO2, C1] 4.0
3.	(a)	Describe the major types of *Azospirillum* inoculants and their methods of application, and briefly discuss the crop responses following inoculation.	[CLO3, PLO2, C2] 4.0
	(b)	Compare *Rhizobium* and *Frankia* with respect to their major biological characteristics, and illustrate the principal infection pathways of *Frankia* in actinorhizal plants.	[CLO2, PLO2, C4] 4.0
4.	(a)	Illustrate the key benefits of mycorrhizal fungi and discuss the major methods of mycorrhizal inoculum production.	[CLO3, PLO2, C5] 4.0
	(b)	Define *Azolla* 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 methods of application of *Rhizobium* inoculants, 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). Symbiotic Nitrogen Fixation (ii). Functions of *Azospirillum*	[CLO3, PLO2, C2] 4.0

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