

[4]				
OR	iii.	Mention about different procedures involved in antibiotic production.	5	1 2 1
Q.3	i.	What is pest resistant gene?	2	1 1 2
	ii.	Explain about molecular plant-microbe interactions.	8	2 1 2
OR	iii.	Explain the molecular mechanism of biological Nitrogen fixation	8	4 2 2
Q.4	i.	What is chlorinated pollutant? Give some example of chlorinated pollutants.	3	1 1 3
	ii.	Why degradation of hydrocarbon is important and write the procedures of hydrocarbon degradation.	7	2 1 3
OR	iii.	What is the importance of biodegradable polymers? Explain details about synthesis of biodegradation pathway of biodegradable polymers.	7	2 2 3
Q.5	i.	How paternity claim can be justified?	4	3 1 4
	ii.	Explain, how biotechnology can be helpful in controlling violent crimes.	6	3 1 4
OR	iii.	Explain different methods of DNA finger printing.	6	2 2 4
Q.6	Attempt any two:			
	i.	Explain details about production of recombinant live vaccines.	5	3 2 5
	ii.	What is gene therapy? Explain in detail.	5	2 2 5
	iii.	What is monoclonal antibody? Mention details about production of monoclonal antibodies.	5	2 2 5

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Total No. of Questions: 6

Total No. of Printed Pages:4

Enrolment No.....



Faculty of Science  
End Sem Examination Dec 2024  
BT3GE03 Biotechnology & Human Welfare  
Programme: B.Sc. Specialisation: Biotechnology

Duration: 3 Hrs.

Maximum Marks: 60

Note: All questions are compulsory. Internal choices, if any, are indicated. Answers of Q.1 (MCQs) should be written in full instead of only a, b, c or d. Assume suitable data if necessary. Notations and symbols have their usual meaning.

		Marks	BL	PO	CO	PSO
Q.1	i.	Enzyme activity assays often use Michaelis-Menten kinetics to assess enzyme function. The Michaelis constant ( $K_m$ ) represents:	1	3	1	1
	(a)	The maximum reaction rate.				
	(b)	The substrate concentration at which the reaction rate is half of $V_{max}$ .				
	(c)	The pH optimum for the enzyme.				
	(d)	The energy required to initiate the reaction.				
	ii.	What is the primary role of $\beta$ -glucanases in polysaccharide metabolism?	1	4	1	1
	(a)	To cleave $\beta$ -glycosidic bonds in cellulose and related polysaccharides.				
	(b)	To hydrolyse $\alpha$ -glycosidic linkages in starch.				
	(c)	To synthesize $\beta$ -glycosidic linkages in glycogen.				
	(d)	To cross-link polysaccharides for structural stability.				
	iii.	One of the main benefits of transferring pest resistance genes to crops, such as Bt genes, is to:	1	1	1	2
	(a)	Increase the nutritional content of crops.				
	(b)	Enhance crop yield by reducing damage from specific pests.				
	(c)	Improve crop tolerance to adverse weather conditions.				
	(d)	Decrease the time required for crop maturation.				

				[2]	
iv.	Which of the following is an essential cofactor in the nitrogenase enzyme complex required for N <sub>2</sub> fixation?	1	2	3	2 1
	(a) Manganese (Mn) (b) Magnesium (Mg)				
	(c) Molybdenum (Mo) (d) Zinc (Zn)				
v.	Chlorinated organic pollutants, such as polychlorinated biphenyls (PCBs), are more difficult to degrade than non-chlorinated organic pollutants primarily because:	1	3	1	3 1
	(a) They are highly soluble in water, making microbial uptake challenging.				
	(b) They do not absorb sunlight, limiting photodegradation.				
	(c) They rapidly volatilize into the atmosphere, making them unavailable for microbial action.				
	(d) Their chlorinated structures are more resistant to enzymatic breakdown due to strong carbon-chlorine bonds.				
vi.	Polyhydroxy butyrate (PHB) is a type of biodegradable polymer produced by certain bacteria. PHB is primarily accumulated in bacteria as:	1	2	1	3 1
	(a) An energy and carbon storage compound.				
	(b) A structural component of the bacterial cell wall.				
	(c) A signaling molecule during stress responses.				
	(d) A defense mechanism against bacterial pathogens.				
vii.	In DNA fingerprinting, Short Tandem Repeats (STRs) are used as markers because they:	1	2	2	4 1
	(a) Are present only in coding regions, making them easy to analyse.				
	(b) Exhibit high variability between individuals, providing a unique genetic profile.				
	(c) Are resistant to degradation and can be analysed even after extended environmental exposure.				
	(d) Have low mutation rates, ensuring their stability across generations.				

				[3]	
viii.	Which of the following is a significant limitation of Single Nucleotide Polymorphism (SNP) analysis in forensic applications compared to STR analysis?	1	4	2	4 1
	(a) SNPs are difficult to analyze due to their large size.				
	(b) SNP analysis requires more complex and expensive equipment than STR analysis.				
	(c) SNPs degrade faster than STR markers in environmental conditions.				
	(d) SNPs provide lower discriminatory power in human identification.				
ix.	Recombinant live vaccines often use attenuated strains of bacteria or viruses. One key advantage of using an attenuated strain in vaccine development is:	1	2	1	5 1
	(a) It elicits a broad immune response similar to natural infection without causing disease.				
	(b) It avoids the need for cold-chain storage during transport.				
	(c) It requires multiple doses to ensure efficacy.				
	(d) It minimizes the risk of genetic reversion to a pathogenic form.				
x.	Monoclonal antibody production in E. coli is challenging primarily because:	1	3	2	5 1
	(a) E. coli is more susceptible to contamination than mammalian cells.				
	(b) Monoclonal antibodies require high levels of disulphide bonding, which E. coli cannot accomplish.				
	(c) Antibody genes are too large for expression in E. coli.				
	(d) E. coli does not perform post-translational modifications like glycosylation, which are necessary for antibody function.				
Q.2	i. What is molecular enzyme engineering?	2	1	1	1 1
	ii. What is antibiotic and what is their importance?	3	2	1	1 1
	iii. Explain the polysaccharide synthesis pathway and the role of different genes/enzymes involved in it.	5	4	2	1 1

## Marking Scheme

### BT3GE03 Biotechnology and Human Welfare

Q. 1	Answer	Answer Explanation	
I	B	The substrate concentration at which the reaction rate is half of V <sub>max</sub> .	1
II	A	To cleave β-glycosidic bonds in cellulose and related polysaccharides.	1
III	B	Enhance crop yield by reducing damage from specific pests.	1
IV	C	Molybdenum (Mo)	1
V	D	Their chlorinated structures are more resistant to enzymatic breakdown due to strong carbon-chlorine bonds.	1
VI	A	An energy and carbon storage compound.	1
VII	B	Exhibit high variability between individuals, providing a unique genetic profile.	1
VIII	D	SNPs provide lower discriminatory power in human identification.	1
IX	A	It elicits a broad immune response similar to natural infection without causing disease.	1
X	D	<i>E. coli</i> does not perform post-translational modifications like glycosylation, which are necessary for antibody function.	1
Q.2	i.	Definition 1 mark Example 1 mark	2
	ii.	Definition 1 mark Importance 2 mark	3
	iii.	Definition 1 mark Pathway 2 Marks Explain genes/enzymes 2 Marks	5
OR	iv.	Definition 1 Mark Procedures application. 4 Marks	5
Q.3	i.	Definition 1 mark Example 1 mark	2
	ii.	Definition 1 Mark Interaction phenomena 4 Marks Example 3 Marks	8
OR	iii.	Definition 1 Mark	8

Chemical pathway 4 Marks  
Example of organism, involved 2 Marks  
Significance 1 Mark

Q.4	i.	Definition 1 Mark Example 1 Mark Explanation 1 Mark	3
	ii.	Definition 1 mark Importance 3 mark Procedures 3 Marks	7
OR	iii.	Definition 1 Mark Example 1 Mark Pathway 3 Marks Diagram 2 Marks	7
Q.5	i.	Definition paternity 1 Mark Process 3 Marks	4
	ii.	Process 3 Marks Analysis 3 Marks	6
OR	iii.	Definition 2 Mark Process 2 Marks Well labelled diagram 2 Marks	6
Q.6		<b>Attempt any two:</b>	
	i.	Definition 1 Mark Molecular Process 2 Marks Production and Example 2 Marks	5
	ii.	Definition 2 Mark Process 2 Marks Example 1 Marks	5
	iii.	Definition 2 Mark Production 2 Marks Application 1 Mark	5

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