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JAYPEE UNIVERSITY OF INFORMATION TECHNOLOGY, WAKNAGHAT
TEST -2 EXAMINATIONS- 2026

M.Tech.-II Semester (BT)

COURSE CODE (CREDITS): 14M11BT215 (3)

MAX MARKS: 25

COURSE NAME: Metabolic Engineering

COURSE INSTRUCTOR: Dr. Saurabh Bansal/Dr. Garlapati

MAX. TIME: 1 Hour 30 Min

Note: (a) All questions are compulsory.

(b) Do all the questions given in each section at the same place.

Q. No.	Question	Marks
Section A		
Q1	Explain in detail about the production of secondary metabolites through hairy root cultures. with probable mechanisms and its cultivation ?	4
Q2	Write in detail about the role of "elicitors" and "exogenous substances". in secondary metabolite production? Summarize the different metabolic strategic approaches utilized for secondary metabolite production.	4
Q3	What is metabolic flux analysis? Describe the methodology for the determination of metabolic pathway fluxes.	4
Section-B		
Q4	Which parameter (k_{cat} or ΔG) determines catalytic speed?	1
Q5	Differentiate between competitive, non-competitive, and uncompetitive inhibition in terms of their effects on K_m and V_{max} . Which type of inhibition is most relevant for feedback regulation in metabolic pathways?	5
Q6 a)	If a pathway step is both thermodynamically unfavorable and catalyzed by a low- k_{cat} enzyme, what dual strategies could be applied to overcome this bottleneck?	3
Q6 b)	"Thermodynamics sets the absolute limits. Kinetics determines how fast we approach them." Critically evaluate this statement in the context of metabolic engineering.	2
Q7	The ΔG° for ATP hydrolysis to ADP + Pi is -30.5 kJ/mol. In a hepatocyte, $[ATP] = 3.5$ mM, $[ADP] = 1.3$ mM, $[Pi] = 5.0$ mM at 37°C . Calculate the actual ΔG for this reaction under these cellular conditions.	2