

**AGRICULTURAL & FOOD ENGINEERING DEPARTMENT
INDIAN INSTITUTE OF TECHNOLOGY KHARAGPUR**

Date of Examination: FN Full Marks: 50 Time: 3 h
Spring End-Semester 2010 Course: M. Tech. (*Applied Botany*)
Subject No. AG60132 Subject Name: **Pharmacognosy & Metabolic Engineering**
No. of Students: 8

Instructions: All questions are compulsory

1. a) Discuss with appropriate schematic diagram, the concept of metabolic reprogramming in the context of terpenoid indole alkaloid manipulation.
b) Schematically represent the late steps of vindoline biosynthesis. (4+4=8)
2. a) Schematically represent the various biochemical pathways of morphine biosynthesis in opium poppy.
b) Discuss a successful case study on RNAi-mediated approach for augmenting the alkaloid levels in opium poppy. (5+5=10)
3. a) Explain with appropriate background information and pathway diagram the reasons for not accumulation of vanillin in tobacco plants upon the expression of bacterial HCHL.
b) Representing the biosynthetic route of shikonin formation, discuss the rationales of expressing bacterial *ubiC* and *ubiA* genes in *L. erythrorhizon* plant. (no drawings of gene constructs and descriptions of effects of expression are needed) (5+5=10)
4. a) Represent the general reaction catalyzed by alcohol acetyltransferase (AAT).
b) Name the products formed by AAT-catalyzed reactions using geraniol and 2-phenylethanol as substrates.
c) What is the rationale for expressing a *Rosa* AAT in *Petunia* flower?
d) Briefly discuss the effects of expressing a *Clarkia* LIS in *Petunia* flower.
e) Why silencing of BPBT led to reduction in benzenoid synthesis in *Petunia* flower? (2+2+2+3+3=12)
5. List at least two names for each of the followings:
a) Microalgae rich in PUFA
b) Worldwide companies producing β -carotene from *Dunaliella*
c) Microalgae producing antiviral compounds
d) Mushroom- and lichen-derived immunomodulatory polysaccharides
e) Algal toxins with their mode of action (2+2+2+2+2=10)