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Roll. No:

NOIDA INSTITUTE OF ENGINEERING AND TECHNOLOGY, GREATER NOIDA

(An Autonomous Institute Affiliated to AKTU, Lucknow)

B.Tech

SEM: VII - THEORY EXAMINATION (2024 - 2025)

Subject: Gene Expression and Transgenic

Time: 3 Hours Max. Marks: 100

General Instructions:

IMP: *Verify that you have received the question paper with the correct course, code, branch etc.*

1. This Question paper comprises of three Sections -A, B, & C. It consists of Multiple Choice Questions (MCQ's) & Subjective type questions.

2. Maximum marks for each question are indicated on right -hand side of each question.

3. Illustrate your answers with neat sketches wherever necessary.

4. Assume suitable data if necessary.

5. Preferably, write the answers in sequential order.

6. No sheet should be left blank. Any written material after a blank sheet will not be evaluated/checked.

SECTION-A 20

1. Attempt all parts:-

1-a. What will be the consequence of not having an origin of replication (ori) in the vector? (CO1,K2) 1

(a) If an ori is absent, replication of vector would not take place

(b) As the cells divide after taking up the vector, both the daughter cells would be having the vector

(c) A colony of transformed colonies is observed

(d) The vector won't be taken up by the cell

1-b. When designing an expression vector for a eukaryotic system, which element is often included to ensure proper secretion of the recombinant protein? (CO1,K1) 1

(a) Kozak sequence

(b) Signal peptide sequence

(c) Shine-Dalgarno sequence

(d) Operator sequence

1-c. Which host organism is often preferred for the over-expression of eukaryotic integral membrane proteins? (CO2,K1) 1

(a) *Saccharomyces cerevisiae*

(b) *E. coli*

(c) *Arabidopsis thaliana*

(d) *Staphylococcus aureus*

1-d. Which of the following techniques is commonly used to improve the solubility of over-expressed integral membrane proteins? (CO2,K1) 1

(a) Increasing expression temperature
(b) Co-expression with chaperone proteins
(c) Lowering the expression level
(d) Reducing the culture volume

1-e. Which of the following is a common method for introducing foreign genes into chloroplasts for transformation? (CO3,K1) 1

(a) Electroporation
(b) Microinjection
(c) CRISPR-Cas9
(d) Polymerase chain reaction (PCR)

1-f. What is a potential benefit of expressing therapeutic proteins in chloroplasts? (CO3.K1) 1

(a) Lower production costs
(b) Increased protein degradation
(c) Greater susceptibility to diseases
(d) Reduced protein yield

1-g. Animals that have had their DNA manipulated to possess and express an extra (foreign) gene are known as _____ (CO4,K1) 1

(a) Transgenic animals
(b) Animals
(c) Infected animals
(d) Bt animals

1-h. What is a potential ethical concern associated with the use of transgenic animals? (CO4,K1) 1

(a) Increased biodiversity
(b) Enhanced research opportunities
(c) Animal welfare and suffering
(d) Easier pet breeding

1-i. What is the main advantage of using transgenic animals in research and biotechnology? (CO5,K1) 1

(a) They can be easily produced in large quantities.
(b) They have a longer lifespan than non-transgenic animals.
(c) They allow scientists to study the effects of specific genes.
(d) They are naturally resistant to diseases.

1-j. What is a common application of transgenic animals in medical research? (CO5,K1) 1

(a) Producing biodegradable plastics

(b) Studying the impact of genes on agricultural crops

(c) Developing new cosmetic products

(d) Modeling human diseases for drug testing and research

2. Attempt all parts:-

2.a.	Why are recombinant protein expression vectors used? (CO1,K2)	2
2.b.	What are integral membrane proteins? (CO2,K1)	2
2.c.	What is the function of the promoter in chloroplast transformation? (CO3,K1)	2
2.d.	What is the significance of the "Oncomouse" in the history of transgenic animals? (CO4,K1)	2
2.e.	What are the advantages of using transgenic animals in the pharmaceutical industry? (CO5,K2)	2

SECTION-B 30

3. Answer any five of the following:-

3-a.	What components are typically found in recombinant protein expression vectors? (CO1,K1)	6
3-b.	How can one optimize the expression of a recombinant protein using vectors? (CO1,K2)	6
3-c.	How do yeast host systems facilitate the overexpression of integral membrane proteins? (CO2,K2)	6
3-d.	Describe the advantages and disadvantages of using prokaryotic (e.g., *E. coli*) and eukaryotic (e.g., yeast or mammalian cells) systems for recombinant protein expression. (CO2,K2)	6
3.e.	Define Good Manufacturing Practices (GMP) and explain their importance in protein production. (CO3,K1)	6
3.f.	What are some safety considerations associated with the creation and use of transgenic animals? (CO4,K1)	6
3.g.	What is the role of transgenic animals in toxicology studies? (CO5,K1)	6

SECTION-C 50

4. Answer any one of the following:-

4-a.	Describe the different types of tags used in recombinant protein expression vectors, such as His, GST, MBP, and GFP. How are these tags useful in protein purification and detection? (CO1,K2)	10
4-b.	Explain the mechanism of tag-based protein purification using affinity chromatography. How does the choice of tag influence the purification process? (CO1,K2)	10

5. Answer any one of the following:-

5-a.	Describe the challenges associated with overexpressing integral membrane proteins in *E. coli* and the strategies employed to overcome them. (CO2,K2)	10
5-b.	Describe the considerations and techniques for overexpressing integral membrane	10

proteins in mammalian cell lines, focusing on Chinese Hamster ovary (CHO) and Human embryonic kidney (HEK) cells. (CO2,K2)

6. Answer any <u>one</u> of the following:-

6-a.	What are the quality control measures in protein purification? How can one assess the purity and functionality of the purified proteins, whether they are tagged or tag-free? (CO3,K2)	10
6-b.	Discuss the applications of protein expression in chloroplasts for the production of pharmaceuticals, vaccines, and industrial enzymes. What are the advantages and limitations of this approach? (CO3,K3)	10

7. Answer any <u>one</u> of the following:-

7-a.	Provide a historical overview of the use of transgenic animals in scientific research and biotechnology. How has the field evolved over time, and what are some notable advancements and achievements? (CO4,K2)	10
7-b.	What are the key ethical concerns, and how do scientists and regulatory bodies ensure the responsible and humane use of transgenic animals? (CO4,K2)	10

8. Answer any <u>one</u> of the following:-

8-a.	How can transgenic animal models be employed in preclinical research for xenografting? What are the future prospects of transgenic animals in xenografting, and how might these applications evolve? (CO5,K3)	10
8-b.	Explain how transgenic animals are utilized in the study of gene function and regulation. (CO5,K3)	10