M. Sc. BIOTECHNOLOGY EXAMINATION, 2025

(2nd Year, 1st Semester)

BIOTECHNOLOGY

PAPER : SC/BT/PG/333T

(Animal and Developmental Biotechnology)

Time : 2 *Hours* *Full Marks* : 40

GROUP—A

Answer *any* **three** questions, each carry **5** marks. 5×3=15

1. *(a)* Discuss the molecular mechanism involved in maintaining the inner cell mass (ICM) and trophoblast lineages in stem cells. 3

(b) What are the characteristics of Mid-Blastula-Transition (MBT) in drosophila? 2

2. *(a)* How does "Nanos" protein regulate Hunchback mRNA transcription? What would be the expression pattern of Hunchback in nanos-mutant Drosophila embryo? 2+1

(b) What would be the phenotype of Drosophila embryo where "Bicoid" protein is ectopically expressed in the posterior end of the embryo? 2

3. *(a)* Name the gene expressed in the posterior most part of each segment and parasegment of Drosophila embryo. 1+1

(b) Researchers have a mouse mutant where Tb×4 is completely absent and Tb×5 is expressed in both the anterior and posterior parts of the body. If only Tb×5 is present during limb formation, explain the phenotype of the mouse with proper justification. 3

4. *(a)* What would be the effect of grafting a small portion of the ZPA cells to the anterior margin of the vertebrate embryo during limb formation? 2

(b) Explain the molecular mechanism in establishing the left-right symmetry in chick embryo. 3

5. *(a)* What would be the effect on germ layer orientation during the formation of primitive streak in chick embryo where the "planner cell polarity pathway" is blocked? 2

(b) Explain the molecular signaling in specifying the two termini of Drosophila embryo. 3

6. *(a)* What would happen if you block the cortical rotation of egg cytoplasm of a fertilized chick embryo? 2

(b) Mutation of which gene would lead to the formation of ventralized embryo in Drosophila and why? 1+2

GROUP—B

Answer *any* **two** questions : 5×2=10

7. *(a)* Mention two significant differences between PNA probe and DNA probe used in Fluorescence *in-situ* hybridization.

(h) Draw the work flow of preparing partially humanized antibodies using separate chimeric light and heavy chain gene library. **[CO2]**

GROUP—D

Answer *any* **one** question : 7×1=7

12. What do you mean by cell line? Discuss how viral genes are used to produce cell lines. Why is sub-culturing or passaging necessary to maintain cells in artificial culture? What are recombinant therapeutic proteins? Give proper examples. (1+2+2+2)

(OR)

"A new type of vaccine that does not present the typical side effects of an attenuated or inactivated viral vaccine has been made possible with the development of rDNA technology using animal cell culture." What is this type of vaccine known as? Briefly discuss this type of vaccine production by cell culture. Write briefly about telomerase-induced immortalization process for cell line production. Briefly write the role of CO_2 and bicarbonate as buffering system of the cell culture media. (1+2+2+2)

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(b) How can a specific sequence on metaphase chromosome be localized with primed *in-situ* labeling (PRINS) technique?

(c) How is comparative genomic hybridization (CGH) technique used to identify chromosomal regions that are gained or lost in tumors? (2+1+2)

8. *(a)* How are the peptide epitopes conjugated with gold nanoparticle for the production of nanovaccine? Give a brief strategy to create a new antibacterial vaccine nanoparticles that are coated with bacterial outer membrane vesicles (OMVs).

(b) How can Shigella flexinary be modified to deliver DNA vaccine?

(c) Vaccinia virus as vaccine delivery agent can provide a high level of immunoprotection against pathogenic organisms. — Briefly discuss. (1+1)+1+2

9. *(a)* Which bacteria produce alginate lyase and how is it beneficial for the treatment of cystic fibrosis?

(b) How are phage antibody libraries constructed? Mention the advantage of recombinant antibody. (2+2+1)

10. *(a)* What is the principle and procedure of the virus neutralization test (VNT)? In which way it is better than complement fixation test?

(b) What is the basic principle of real-time polymerase chain reaction (PCR) genotyping? Why TaqMan probes is preferred than SYBR Green? (1½+½)+2+1

GROUP—C

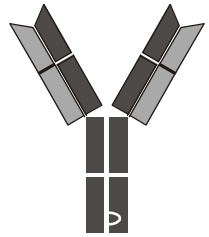
Answer *any* **four** questions : 2×4=8

11. *(a)* Name one modification for antibody delivery crossing the BBB to treat glioma. Explain the term leukosome. **[CO2]**

(b) Name one disease where biomimetic modification is done for homologous targeting. Name one vascular disrupting agent. **[CO2]**

(c) State the difference between humanized mAb and chimeric mAb. Define the terms scFv and sdA. **[CO2]**

(d) What are BiTEs? State the Ig subtype of following diagram. **[CO2]**



(e) Explain glycosylation with example in Fc region engineering. **[CO2]**

(f) Explain antigenized antibodies with example. **[CO2]**

(g) Why does HAT medium require thymidine? What we need to do to save myeloma partner cells from death in a culture medium lacking HGPRT in presence of an inhibitor of de novo purine synthesis? **[CO2]**