KATHMANDU UNIVERSITY
End Semester Examination
June/July, 2023

Marks Scored:

Level : B.Tech.
Year : II

Course : BIOT 208
Semester : I

Exam Roll No. :

Time: 30 mins.

F. M. : 20

Registration No.:

Date : 13 JUL 2023

SECTION "A"
[20 Q. × 1 =20 marks]

Encircle the most appropriate option from the given choices.

1. In humans, the progression from spermatogonial stem cell to mature spermatozoa takes about
   a. 48 hours b. 35 days c. 65 days d. 3 months

2. The eggs of most of the birds, fishes and reptiles are
   a. isolecithal b. mesolecithal c. telolecithal d. centrolecithal

3. Dosage compensation in *Drosophila* is controlled by
   a. *msl2* b. *dsx* c. *Tra2* d. *Fruitless*

4. The cadherin that is highly expressed on cells of the developing central nervous system and may play roles in mediating neural signals is
   a. E-cadherin b. N-cadherin c. P-cadherin d. R-cadherin

5. DNA methylation mostly occurs in
   a. Adenine b. Guanine c. Thymine d. Cytosine

6. Which protein induces the follicle cells in *Drosophila* to differentiate to ventral morphology?
   a. Bicoid b. Nanos c. Ventral d. Dorsal

7. Which stem cells are able to give rise to bone, cartilage, muscle, and fat lineages?
   a. Hematopoietic stem cells
   b. Bone marrow-derived mesenchymal stem cells
   c. Epithelial stem cells in the lining of the digestive tract
   d. Skin stem cells occur in the basal layer of the epidermis

8. Large shielded cotyledon situated towards lateral side of embryonal axis in a monocot embryo is
   a. scutellum b. coleoptile c. coleorhiza d. epiblast

9. Haplo-diplontic life cycle is seen in
   a. Angiosperms
   b. Gymnosperms
   c. Spirogyra, Volvox, and Chlamydomonas
   d. Bryophytes and Pteridophytes

10. Among the proteins involved in the flower organ specification in *A. thaliana*, which class does APETALA 3 [AP3] belong?
    a. Class A b. Class B c. Class D d. Class E

Fill in the blanks

11. _____ is the view supported by Aristotle and William Harvey that the organs of the embryo are formed de novo ("from scratch") at each generation.

12. A slow block to polyspermy in mammals occurs by enzymes from the _____ modifying the zona pellucida proteins.

13. A hormone that enables the development of the Mullerian duct into the uterus, oviducts, cervix, and upper end of the vagina is _____.

14. When bound to the nucleosomes of active genes, _____ proteins keep these genes active, whereas _____ proteins, which bind to condensed nucleosomes, keep the genes in an inactive state.

15. When the oocyte nucleus of *Drosophila* moves toward the terminal follicle cells and synthesizes gurken protein, the terminal follicle cells express _____, the receptor for gurken.

16. The ability of cells or tissues to respond to a specific inductive signal is called _____.

17. According to oxidative damage theory, aging is a result of metabolism and its by-products _____that can oxidize and damage cell membranes, proteins, and nucleic acids.

18. Electroporation with _____ protein enhances normal regeneration in salamanders whose limb is denervated and amputated.

19. The ploidy level of endosperm in angiosperms is _____.

20. FLOWERING LOCUS T (FT) protein, produced in the leaves of floweing plant is transported through the phloem to the shoot apical meristem, where it complexes with the _____ protein to activate floral meristem identity genes.

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Time : 2 hrs. 30 mins.

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Semester : I
F. M. : 55

SECTION "B"
[3Q. × 7 = 21 marks]

Attempt *ANY THREE* questions.

1. Illustrate the developmental cascades leading to male and female sex determination in mammals.
2. What are the different types of stem cells based on their potency? Define iPSC cells and write their potentialities.
3. Microphthalmia transcription factor "*Mitf*" mutant mice, homozygous *White* mice and homozygous *Steel* mice are all white. Are all these genes (*Mitf*, *Steel*, and *White*) involved in the same developmental pathway? Explain with the signal transduction pathway.
4. Discuss with diagram the stages in the development of a typical dicot embryo.

SECTION "C"
[6Q × 4 = 24 marks]

Attempt *ANY SIX* questions.

5. What determines the timing of meiosis initiation and sexual differentiation of mammalian germ cells? Explain with diagram.
6. What do you mean by gastrulation? What are the different modes of gastrulation?
7. Describe the function of head and foot inhibition gradients in the budding of hydra.
8. Define aging. Why does the gene expression pattern of genetically identical twins differ with aging?
9. Discuss the roles of homeotic genes in the floral development of *Arabidopsis thaliana*.
10. Differentiate between gametophytic and sporophytic self-incompatibility in plants.
11. What are micro RNAs? How do they block translation?

SECTION "D"
[5Q × 2 = 10 marks]

12. Write short notes on (*ANY FIVE*).
    a. von Baer's laws of embryology
    b. Acrosome reaction
    c. *Sex-lethal* gene in Drosophila
    d. Reciprocal induction
    e. Differential adhesion hypothesis
    f. Differences in plant and animal development
    g. Microgametogenesis