Name of the Programme: **M.Sc. Zoology**

Course Code: ZOO-508 **Title of the Course:** Molecular Aspects of Developmental Biology

Number of Credits: 03

Effective from AY: 2023-24

Pre-requisites for the Course:	A basic understanding of cellular and molecular biology is essential.	
Course Objectives:	1. To provide a comprehensive understanding of the concepts of early animal development 2. To compare and contrast various events that occur during gametogenesis, cleavage formation and fertilization. 3. Construct in-depth knowledge of cell signalling pathways that regulate embryonic induction, tissue interactions, pattern formation and expression of regulatory genes. 4. Critically assess the current scientific literature on topics related to developmental biology.	
Content:	**Module 1** Mammalian Gametogenesis: ultra structure of sperm and egg; Molecular events in mammalian fertilization (capacitation, prevention of polyspermy, genetic fusion, activation of egg metabolism). Cleavage in mammals, the difference between somatic mitosis and cleavage, regulation of cleavage. Gastrulation (epiboly and emboly). Development of Extra embryonic membrane. **Module 2** Mechanism of cell cellular differentiation; Stages of Commitment (differentiation, specification and determination; cellular communication: paracrine factors and signal transduction cascades (Jak-Stat pathway, smooth and patched protein pathway, wnt signalling pathway, SMAD pathway). Developmental dynamics of cell speciation: Specification of body axes in sea urchin-, insect-, fish-, avian- and mammalian embryo. **Module 3** Induction and competence; a cascade of induction during the formation of a lens; epithelium-mesenchyme interaction during the formation of feathers in a bird.	7 hours 5 hours 3 hours 8 hours 7 hours 5 hours

	The central nervous system and the epidermis: Primary and Secondary neurulation; Differentiation of the Neural Tube. Embryonic field; Pattern formation in vertebrate limbs, generation of the proximal–distal, anterior–posterior, dorso - ventral axis of the limb. Regeneration ability of animals; Role of Interstitial cells in Regeneration in Hydra. Molecular mechanism of regeneration of limb in Salamander.	4 hours 3 hours 3 hours
Pedagogy:	Lectures/tutorials/online teaching mode/self-study.	
References/ Readings:	1. M.J.F. Barresi and S.F. Gilbert, Developmental Biology (12th edition), Oxford University Press, UK, 2019. 2. B.M. Carlson, Pattern's Foundation of Embryology, Mc Graw Hill Inc., USA,2003. 3. S.F. Gilbert, Developmental Biology (5th edition), Sinauer Associates Inc.,2003. 4. S.F. Gilbert, Developmental Biology (10th edition), Sinauer Associates Inc., Sunderland, USA, 2016. 5. S.F. Gilbert, Developmental Biology (8th edition), Sinauer Associates Inc., Sunderland, USA. 2006. 6. S.A. Moody, Principles of Developmental Genetics, Academic Press., New York, 2015. 7. J.M.W. Slack, Essential Developmental Biology, Willey Publication, USA, 2012. 8. L. Wolpert, C. Tickle and A.M. Arias, Principles of Development, Oxford University Press, 2019.	
Course Outcomes:	The learner will 1. Appraise the morphological process that transforms a fertilized egg into a multicellular organism. 2. Assess the molecular, biochemical and cellular events that regulate the development of specialised cells, tissue and organs during embryonic development. 3. Compare different model organisms which can be used to investigate various developmental processes. 4. Justify how different genes control axis formation in invertebrates and vertebrates. 5. Create comprehensive knowledge of various steps involved in Pre and Post- fertilization process in mammals.	

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