DISCIPLINE SPECIFIC ELECTIVE COURSE –DSE-12

Course title & Code	Credits	Credit distribution of the course			Eligibility criteria	Pre-requisite of the course (if any)
		Lecture	Tutorial	Practical/ Practice		
Developmental Biology (BS-DSE-12)	**4**	**2**		**2**	Class XII pass with Biology and chemistry, as one of the papers in Class XII	**NA**

Learning Objectives:

The main objective of Developmental Biology course is to provide four-dimensional thinking of students to truly understand the patterns and process of embryonic development, body plan, fate map, induction, competence, regulative and mosaic development, molecular and genetic approach for the study of developing embryo which is not necessarily shared with any other disciplines in the biological sciences. The relevance of Developmental Biology to the study of human disease will be exemplified throughout using different model organisms.

Learning Outcomes:

Upon completion of the course, students will be able to:

- Understand the fundamental processes that underpin the fertilization of an egg cell and its step-by-step transformation into the fascinating complexity of a whole organism.
- Learn how a cell behaves in response to an autonomous determinant or an external signal depends on the combination of transcriptional and posttranscriptional regulators, signaling pathway components, cytoskeletal elements, and other proteins and RNAs that it has synthesized earlier: i.e., on its developmental history. Students learn best by doing and by having the opportunity to put what they havelearned into practice. Therefore, various model organism will be used as a learning tool.
- Understand that cells only express a proportion of their genome, and that differential gene expression underlies cell differentiation and any alteration in the entire process of development leads to devastating diseases.

SYLLABUS FOR DSE-12
Course Contents- Theory

Unit 1: Introduction **No. of hours: 5**

Historical perspective and basic concepts of developmental biology: cell division, cell differentiation, morphogen and morphogenetic gradient, patterning; EVO-DEVO concept. Model organisms

Unit 2: Early Embryonic Development **No. of hours: 10**

Post fertilization events: Planes and patterns of cleavage; Types of Blastula; Fate maps (including Techniques); Early development of frog and chick up to gastrulation; Embryonic induction and organizers

Unit 3: Late and post Embryonic Development **No. of hours: 10**

Fate of Germ Layers; Formation of neural tube and neural tube defects , Formation of Extra-embryonic membranes in birds; Placenta (Structure, types and functions of placenta) Modes of regeneration-epimorphosis,morphallaxis and compensatory regeneration (with one example each). Aging- genes involved in alteration in timing of senescence

Unit 4: Gene regulation in development No. of hours: 5 Axis specification in Drosophila: role of maternal genes, patterning of early embryo by zygotic genes: gapgenes, pair-rule genes, segment polarity genes, homeotic selector genes- bithorax and antennapedia complex.

3.1 PRACTICAL

Credit: 2 **Total Hours: 60**

1. Study of whole mounts and sections of developmental stages of frog through permanent slides: Cleavage stages, blastula, gastrula, neurula, tail-bud stage, tadpole (external and internal gill stages)
2. Study of whole mounts of developmental stages of chick through permanent slides (Hamburger and Hamilton Stages): Stage 3 (Intermediate Streak)-13 hours, Stage 4 (Definitive Streak)-18 hours, Stage 5 (Head Process)-21 hours, Stage 7-24 hours, Stage 8-28 hours, Stage10-33 hours, Stage 11-40 hours, Stage 13-48 hours, Stage 19- 72 hours and Stage 24-96 hours of incubation
3. Demonstration of culture of chick embryo from fertilized eggs to study various developmental stages.
4. Study of the developmental stages and life cycle of Drosophila from stock culture.
5. Study of different sections of placenta (photomicrographs/ slides).
6. Project report on Drosophila culture/chick embryo /Zebra fish development.
7. A visit to Poultry Farm/IVF Centre/Zebra fish lab

3.2 Essential readings:

1. Gilbert, S. F. (2010). Developmental Biology. IX Edition, Sinauer Associates, Inc. Publishers,Sunderland, Massachusetts, USA
2. Balinsky B. I. and Fabian B. C. (2006). An Introduction to Embryology. VIII Edition, InternationalThompson Computer Press.
3. Slack, J.M.W. (2013) Essential Developmental Biology. III Edition, Wiley- Blackwell.

Suggested Readings:

1. Wolpert, L. (2002). Principles of Development. II Edition, Oxford University Press.
2. Kalthoff, K. (2001). Analysis of Biological Development. II Edition, McGraw Hill Publishers.
3. Carlson, B.M. (2007) Foundations of Embryology. VI Edition, Tata McGraw-Hill Publishers.
4. Arora, R. and Grover, A. (2018) Developmental Biology: Principles and Concepts. I Edition, R. Chand& Comp