Course Code	Course Name	Credits
26ZY504	EMBRYOLOGY	04

Course Objectives

- To understand the fundamental concepts and principles of embryology.
- To explain the processes of gametogenesis, fertilization, and early embryonic development.
- To develop knowledge on cleavage, gastrulation, organogenesis, and morphogenesis.
- To analyze developmental mechanisms, regeneration, and differentiation in animals.
- To enhance scientific understanding of growth, development, and congenital abnormalities.

Learning Outcomes

- Explain the basic concepts and stages of embryonic development.
- Differentiate the processes of gametogenesis, fertilization, and cleavage in animals.
- Examine gastrulation, organ formation, and developmental patterns in vertebrates.
- Analyze mechanisms of regeneration, differentiation, and developmental regulation.
- Apply embryological concepts in developmental biology, research, and related biological studies.

Unit 1 – Concept of Developmental Biology (12 Hrs.)

Pattern of animal development. Gametogenesis: Origin of germ cells, spermatogenesis - Sperm morphology in relation to the type of fertilization, Oogenesis - Oogenesis in insects and amphibians; Composition and synthesis of yolk in invertebrates (insects and crustaceans) and vertebrates; Genetic control of vitellogenin synthesis in amphibians.

Unit 2 – Fertilization (12 Hrs.)

Sperm aggregation, Sperm activation, Chemotaxis, Sperm maturation and capacitation in mammals, Acrosome reaction. Sperm – egg interaction. Sperm entry into the egg - Egg activation - Intracellular calcium release - Cortical reaction - Physiological polyspermy - Fusion of male and female pronuclei - Post fertilization metabolic activation – Parthenogenesis.

Unit 3 - Cleavage and gastrulation (12 Hrs.)

Pattern of embryonic cleavage, mechanisms of cleavage, Factors affecting gastrulation, mechanisms and types of gastrulation in animal embryos - Mammals; Fate maps - (Amphibian and Chick), Epigenesis and preformation – Formation of primary germ layers.

Unit 4 – Embryonic Development (12 Hrs.)

Embryonic development of fish and birds, formation of extra embryonic membranes in mammalian – Organogenesis – Development of endodermal, mesodermal and ectodermal derivatives. Embryonic Induction and neurulation; Formation and migration of neural crest cells - types of neural crest cells and their patterning - primary and secondary neurulation.

Unit 5 - Metamorphosis (12 Hrs.)

Post embryonic development metamorphosis: Endocrine control of metamorphosis in insect and amphibian - Endocrine control of moulting and growth in insects - Neoteny and pedogenesis. Regeneration: Formation of ectodermal cap and regeneration blastema – Types of regeneration in planaria, Regenerative ability in different animal groups, Factors stimulating regeneration and Biochemical changes.

Reference Books:

6. Verma, P.S., & V.K. Agarwal (2004). Chordata Embryology; S. Chan & Co Ltd; New Delhi.
7. Subramoniam. T. (2002). Developmental Biology, Narosa Publication, New Delhi.
8. Balinsky, B.L., (1981). An Introduction to embryology, Saunders, Philadelphia.
9. Grant, P., (1978) Biology of developing system, Halt Rein Chart and Winston Inc., NY and Chicago.
10. Gilbert, S (1985) Developmental Biology. Sinauer Association, Inc., Publishers.

RFERENCE WEB LINKS:

https://embryology.med.unsw.edu.au/embryology/index.php/Main_Page
https://www.biologydiscussion.com/embryology
https://www.easybiologyclass.com/category/embryology/