BACHELOR WITH BIOTECHNOLOGY AS MAJOR (CT - I)

5th SEMESTER

BTG 522J1 BIOTECHNOLOGY _ DEVELOPMENT AND SYSTEM BIOLOGY

CREDITS: THEORY – 3, PRACTICAL – 1

- **Course Learning Objective:** The objective of this course is to provide a comprehensive understanding of the concepts of animal and plant development and offer introduction of systems biology.
- **Course outcome:** A student will be able to;
  - define the different terms related to developmental biology and learn about stages of development in plants.
  - recognize the different events in animal development.
  - integrate use of systems biology in understanding complex processes.

Unit -1(15 HOURS)

Introduction to developmental biology and its significance. Key principles: cell theory, specification, competence, determination, differentiation and cell lineages. Basic developmental biology (plants): development of male and female gametophyte, embryogeny, organogenesis and organ polarity. Floral transition/induction, floral organ pattering and determinancy (Arabidopsis).

Unit -2 (15 HOURS)

Gametogenesis: spermatogenesis and oogenesis. Fertilization mechanisms and early embryonic development. Pattern formation in early embryos. Role of signaling molecules in development: Notch, Wnt, and Hedgehog signaling pathways. Homeotic genes and organogenesis. Organ development and insights: limb, eye, and heart development (D. melanogaster and M.musculus)

Unit -3 (15 HOURS)

Introductions to systems biology: Key concepts of systems biology- holistic perspective. Networks: definition of nodes and edges (links).Types of networks: random networks, hierarchical networks, and scale-free networks. Cellular networks: concept of protein-protein interaction networks (PPINs) and metabolic networks. Gene networks: positive and negative feed-back loops. Concept of synthetic biology.

PRACTICALS (1CREDITS: 15 hours)

1. Study of life cycle of Drosophila melanogaster from photographs/stock culture.
2. Study of developmental stages of any model organism using images/models.
3. Study use of systems and synthetic biology with examples.

BOOKSRECOMMENDED

1. Gilbert SF, Developmental Biology, Sinauer Associates
2. Wolpert L, Beddington R, Jessell T, Lawrence P, Meyerowitz E, Smith J, Principles of development, Oxford university press.
3. An Introduction to Systems Biology: Design Principles of Biological Circuits (Chapman & Hall/CRC.
4. Edda Klipp, Wolfram Liebermeister, Christoph Wierling, Axel Kowald, Systems Biology: A Textbook, Wiley.