

Course Objectives:

The Objectives of the courses are:

1. To teach about animals' diversity adapted in different strategies' for performance of their similar functions through modifications in body parts in past and present times.
2. To impart understanding of diverse strategic structural adaptations in each of the functions of integumentary, skeletal, muscular, nervous and sensory, endocrine, circulatory and respiratory systems for effective survival in their specific conditions.
3. To understand the organ systems, their specialization and coordination with each other and constantly changing internal and external environment, inside and outside the animal's body.
4. To embrace the phenomena in basic structure of each system that determines its particular function.

Course Learning Outcomes:

1. **Acquire** the concept that for the performance of a function for example exchange of respiratory gases the different forms are adapted in the environments e.g. gills in aquatic and lungs in terrestrial environment.
2. **Understand** that diverse forms adapted to perform the same functions are because of the different past and present conditions.
3. **Solve** of emergence of diversity of forms for the performance of similar function.
4. **Analyze** the requirements of diverse forms for the performance of similar function in their past and present needs.
5. **Evaluate** the adaptations in forms for its efficiency in managing the function in differing situations in the past and present times.
6. **Demonstrate** that a form is successfully adapted to perform a function adequately and successfully.

Course Outline:

1. Protection, Support, and Movement:
 - Protection: the integumentary system of invertebrates and vertebrates;
 - Movement and support: the skeletal system of invertebrates and vertebrates;
 - Movement: non-muscular movement; an introduction to animal muscles; the muscular system of invertebrates and vertebrates
2. Communication I:
 - Nerves: Neurons: structure and function.
3. Communication II:
 - Senses: Sensory reception: baroreceptors, chemoreceptors, georeceptors, hygrometers, phonoreceptors, photoreceptors, proprioceptors, tactile receptors, and thermoreceptors of invertebrates
 - Lateral line system and electrical sensing, lateral-line system and mechanoreception, hearing and equilibrium in air and water, skin sensors of mechanical stimuli, sonar, smell, taste and vision in vertebrates.
4. Communication III:
 - The Endocrine System and Chemical Messengers: Chemical messengers: hormones chemistry; and their feedback systems; mechanisms of hormone action
 - Hormones with principal function each of Porifera, Cnidarians, Platyhelminthes, Nemertans,

Nematodes, Molluscs, Annelids, Arthropods, and Echinoderms invertebrates; an overview of the vertebrate endocrine system; endocrine systems of vertebrates, endocrine systems of birds and mammals

5. Circulation and Immunity:

- Internal transport and circulatory systems in invertebrates
- Characteristics of invertebrate coelomic fluid, hemolymph, and blood cells
- transport systems in vertebrates; characteristics of vertebrate blood, blood cells and vessels; the hearts and circulatory systems of bony fishes, amphibians, reptiles, birds and mammals; the human heart: blood pressure and the lymphatic system; immunity: nonspecific defenses, the immune response

Practicals:

1. Study of insect chitin, fish scale, amphibian skin, reptilian scales, feathers and mammalian skin.
2. Study and notes of skeleton of Labeo (*Labeo rohita*), Frog (*Hoplobatrachus tigerinus*), Varanus (*Varanus bengalensis*), fowl (*Gallus gallus domesticus*) and rabbit (*Oryctolagus cuniculus*).

Note: Exercises of notes on the adaptations of skeletons to their function must be done.

3. Earthworm or leech; cockroach, freshwater mussel, Channa or Catla catla or Labeo or any other local fish, frog, pigeon and rat or mouse and rabbits dissections as per availability.
4. Study of heart, principal arteries and veins in a representative vertebrate (dissection of representative fish/mammals).

Teaching-Learning Strategies

Teaching will be a combination of class lectures, class discussions, and group work. Short videos/films will be shown on occasion.

Assignments

The sessional work will be a combination of written assignments, class quizzes, presentation, and class participation/attendance.

Assessments and Examination

Sessional Work: 25 marks

Midterm Exam: 35 marks

Final Exam: 40 marks

Books Recommended:

1. Pechenik, J.A. 2013. Biology of Invertebrates, 4th Ed. (International), Singapore: McGraw-Hill.
2. Hickman, C.P., Roberts, L.S., Larson, A. 2004. Integrated Principles of Zoology, 11th Ed. (International), Singapore: McGraw-Hill.
3. Miller, S.A. and Harley, J.B. 2002. Zoology, 5th Ed. (International), Singapore: McGraw-Hill.
4. Campbell, N.A. 2002. Biology, 6th Ed. Menlo Park, California: Benjamin/Cummings Publishing
5. Kent, G.C., Miller, S. 2001. Comparative Anatomy of Vertebrates. New York: McGraw-Hill.
6. Hickman, C.P., Kats, H.L. 2000. Laboratory Studies in Integrated Principles of Zoology. Singapore: McGraw-Hill.
