KAZI NAZRUL UNIVERSITY

[Kalla Bypass More, North, P.O, C H Kalla, Asansol, West Bengal 713340]

SYLLABUS

B.Sc. PROGRAM IN ZOOLOGY

(With effect from the academic session: 2020-21)

SCHEME AND SYLLABUS

SEMESTER	Core Course (12)	Ability Enhancement Compulsory Courses AEC (2)	Skill Enhancement Courses SEC (4)	Discipline Specific Elective DSE (4)
I	CC Botany-I CC Zoology-I CC Chemistry-I	Environmental Science		
II	CC Botany-II CC Zoology-II CC Chemistry-II	English Communication		
III	CC Botany-III CC Zoology-III CC Chemistry-III		SEC-I	
IV	CC Botany-IV CC Zoology-IV CC Chemistry-IV		SEC-II	
V			SEC-III	DSE Botany-I DSE Zoology-I DSE Chemistry-I
VI			SEC-IV	DSE Botany-II DSE Zoology-II DSE Chemistry-II

SEMESTER-I (PROGRAM)

Course Name: Systematics and Diversity of Life Protists to Chordates

Course Code: BSCPZOOC101

Course Type: **Core**	Course Details: **CC-1**			L-T-P: **4-0-4**	
Credit: **6**	Full Marks: **100**	CA Marks		ESE Marks	
		Practical	Theoretical	Practical	Theoretical
		30	**10**	**20**	**40**

About the course

The course is a walk for the Bachelor's entrant through the amazing diversity of living forms from simple to complex one. It enlightens how each group of organisms arose and how did they establish themselves in the environment with their special characteristics. It also deals with the differences and similarities between organisms on the basis of their morphology and anatomy which led to their grouping into taxa and clades.

Learning outcomes

After successfully completing this course, the students will be able to:

- Develop understanding on the diversity of life with regard to protists, non chordates and chordates.
- Group animals on the basis of their morphological characteristics/ structures.
- Develop critical understanding how animals changed from a primitive cell to a collection of simple cells to form a complex body plan.
- Examine the diversity and evolutionary history of a taxon through the construction of a basic phylogenetic/ cladistics tree.
- Understand how morphological change due to change in environment helps drive evolution over a long period of time.

• The project assignment will also give them a flavour of research to find the process involved in studying biodiversity and taxonomy besides improving their writing skills. It will further enable the students to think and interpret individually due to different animal species chosen

THEORY

Unit I: Origin of Life on Earth, Products of evolutionary process (13 Lectures)

Origin of life on Earth: Arrival of simple form from primordial chemicals. Multicellularity: from simple collections of poorly differentiated cells to complex body plans. Biological diversity. Systematics and taxonomy. Species concept, clades. Nomenclature and utility of scientific names. Classification: morphological and evolutionary (molecular). Relationship of taxa: phylogenetics and cladistics with special reference to paraphyly, monophyly, apomorphy, plesiomorphy and phenoplasticity.

Unit II: Diversity in Protists and acoelomate Metazoa (13 Lectures)

Structure and diversity in Protists (classification up to Phylum). Origin of Metazoans: diploblastic and triploblastic organization; symmetries; body cavities; protostomes and deuterostomes. Porifera: Characters and classification of up to classes). Cnidarians: Special features; polymorphism and division of labour; coral reef forming cnidarians, types & significance, classification up to classes. Basic characteristics, classification of Platyhelminthes up to classes.

UNIT III: Diversity in pseudocoelomate and coelomate Non chordates (13 Lectures)

The Ecdysozoa: characteristics of the representative taxa. Pseudocoelomates; Basic organization and adaptive radiations in roundworms. Classification of Nematoda up to classes. The coelomates: Classification of arthropods up to classes. Basic organization and diversity (classification up to classes) in Annelids. Basic organization and diversity (classification up to classes) in Molluscs. Basic organization and classification (up to classes) of Echinoderms; their affinity to Chordates.

Note: Classification to be followed from Ruppert and Barnes Invertebrate Zoology VI edition, except for Protozoa (American Association of Protozoologist ref: Levine 1980) and Porifera (Brusca and Brusca 2002; IV edition. Invertebrate Zoology)

UNIT IV: Diversity in Protochordates and Chordates (13 Lectures)

Chordates– Primitive Chordates and their affinities. Hemichordates, Urochordates and Cephalochordates. Advent of vertebrates: Cyclostomes, their evolutionary status and affinities. Basic organization and diversity (classification up to order) of fishes, their evolutionary transitions from Water to Land invasion- Early Tetrapodes. Amphibians diversity (classification up to order) and adaptability to dual mode of life. Adaptive radiations in reptiles, classification of reptiles up to order; the avian ancestors. Birds: Adaptation from terrestrial to aerial mode of life. Origin of Mammals- Special features of Monotremes and Marsupials. Characteristics and classification of mammalian groups (up to orders) with special reference to primates.

Note: Classification from Young, J. Z. (1981) to be followed except for classification fishes. For Pisces classification scheme to be followed from Nelson, J. S. (2006).

PRACTICAL

1. Study of animals through slides and museum specimens/photographs in the laboratory with their classification, biogeography and diagnostic features (record book). Animals to be included for the study are as follows:

   Euglena, Amoeba, Paramecium, Obelia, Physalia, Porpita, Euspongia, Scypha, Aurelia, Tubipora, Sea Anemone, *Pennatula, Fungia, Fasciola hepatica, Taenia solium, Ascaris, Aphrodite, Sabella, Chaetopterus, Pheretima, Carcinoscorpius, Macrobrachium, Balanus, Julus, Periplaneta, Peripatus, Chiton, Pila, Pinctada, Sepia, Astropecten, Cucumaria* and *Antedon.*

   Balanoglossus, Branchiostoma, Ascidia, Scoliodon, Torpedo, Mystus vitattatus, Catla, Exocoetus, Hippocampus, Ichthyophis, Necturus, Bufo, Rachophorous, Chelone, Calotes, Chamaeleon, Draco, Bungarus, Vipera, Naja, Psittacula, Pycnonotus, Sorex, Pteropus, Funambulus.

2. Study of animals in nature during a survey of a National Park or Forest area or any local biodiversity rich area.
3. Collection of five species or presentation through photographic plates (preferably invertebrates, insects) belonging to a clade. A project work on their generic identification, description and illustration with a note on their locality. Also the assessment of their relationship by constructing a cladogram using characters and character states.
4. Comparison of two species of birds belonging to same genus (Interspecific difference).
5. Comparison and weighting of characters of two birds belonging to same family but dissimilar genera.
6. Group discussion or Seminar presentation on one or two related topics.

SEMESTER-II (PROGRAM)

Course Name: Comparative Anatomy & Physiology of Nonchordates

Course Code: BSCPZOOC201

Course Type: **Core**	Course Details: **CC-2**			L-T-P: **4-0-4**	
Credit: **6**	Full Marks: **100**	CA Marks		ESE Marks	
		Practical	Theoretical	Practical	Theoretical
		30	**10**	**20**	**40**

About the course

The course makes a detailed comparison of the anatomy of the different taxa of non chordates. It also highlights how in the taxonomic hierarchy, there is an increase in the complexity of structure and function. The course thus gives an overview of the intricate life processes and adaptive radiations in non chordates.

Learning outcomes

After successfully completing this course, the students will be able to

- Develop an understanding of the characters used to classify besides being able to differentiate the organisms belonging to different taxa.

- Acquire knowledge of the coordinated functioning of complex human body machine.
- Have hands on experience of materials demonstrating the diversity of protists and non-chordates.
- Understand the relative position of individual organs and associated structures through dissection of the invertebrate representatives.

- Realize that very similar physiological mechanisms are used in very diverse organisms.
- Get a flavor of research by working on project besides improving their writing skills. It will further enable the students to think and interpret individually.

- Undertake research in any aspect of animal physiology in future.

THEORY

UNIT I: Diversity of Tegument and Digestive system (13 Lectures)

Symmetry, Coelom development and diversity. Cell membrane in protists and its derivatives. Tegument in non-chordates and its derivatives. Nutrition and feeding modes in protists. Digestive system & feeding mechanism in non-chordates): Process of digestion from food vacuoles to complex digestive organs.

UNIT II: Diversity of Locomotory, Respiratory, Circulatory and Excretory systems (13 Lectures)

Locomotion and diversity of locomotory organs in protists and non-chordates, muscle and locomotion, Structure and diversity of skeletal elements in protists and non-chordates. Respiration: diversity of respiratory organs, modes of respiration. Respiratory pigments. Circulation and the diversity of circulatory system. Excretion (protists): endocytosis, exocytosis; Outline on excretion and diversity of excretory organs in non chordates.

UNIT III: Diversity of Nervous and Reproductive systems (13 Lectures)

Nervous system with special reference to diversity in brain and nerve chord. Neuroendocrine systems, pheromones. Sense organs: Mechanoreceptors and their diversity in different taxa. Sense organs: photoreceptors, chemoreceptors, thigmoreceptors, rheoreceptors and proprioceptors in different taxa. Olfaction and sound perception in insects, etc. Metamorphosis. Diversity of larval forms in non-chordates.

UNIT IV: Evolution and characteristics of important Non Chordate taxa (13 Lectures)

Affinities of living fossils, *Limulus* and *Peripatus.* Polymorphism and colony formation. Parasitic adaptations and life cycle patterns in parasites belonging to different taxa. The parasites

listed by World Health Organization under preventive programmes. Structure and diversity of the pest organisms. Invertebrate model organisms and their importance. Types of canal systems in sponges and their significance. Torsion and detorsion in Mollusca. Components of water vascular system in echinoderms.

Recommended readings

1. Barrington, E J W. (1967) Invertebrate structure and function, Nelson, London.

2. Barnes, R. D. (1968) Invertebrate Zoology, 2nd Ed. Saunders, Philadelphia.

3. Hyman, L H. (1940-67). The Invertebrates, Vol. I-VI. McGraw-Hill, New York.

4. Barnes, R.S.K., Calow, P., Olive, P.J.W., Golding, D.W. and Spicer, J.I. (2002) The Invertebrates: A New Synthesis. III Edition. Blackwell Science.

5. Boradale, L.A. and Potts, E.A. (1961) Invertebrates: A Manual for the use of Students. Asia Publishing Home.

6. Marshall, A.J and Williams, W.D. (1995) Text book of Zoology-Invertebrates. VII Ed., Vol. I, A.L.T.B.S. Publishers.

7. http://abacus.bates.edu/acad/depts/biobook/AnimPhyl.pdf

PRACTICAL

1. Study of slides or models or photographs of specimens of

Protozoans of agricultural importance.

Coral-reef forming Cnidarians

Plant parasitic nematodes

Nematodes used as models in experimental biological research

2. Dissection of *Periplaneta* to expose the digestive system, nervous system and reproductive system.

3. Dissection of *Palaemon* to expose appendages and Statocyst.

4. Dissection of *Pila* to expose the digestive system and Statocyst.

5. Study of larval forms: *Ephyra*, *Planula*, *Trochophore*, *Pluteus*, *Velliger*, Zoea, Metazoea, Bipinnaria

6. Some videos to develop understanding on the animals of different taxa.

7. Group discussion or Seminar presentation on one or two related topics