



Course Outline

Programme	BS Science Education	Course Code	SE-304	Credit Hours	3
Course Title	Zoology II: Invertebrate Diversity (Classification, Phylogeny and Organization)				
Course Introduction					
<p>This course will provide the knowledge of evolutionary/phylogenetic relationship (from simple to the complex organisms), the basic taxonomic characteristics and classification of all the invertebrate phyla, and understanding of their body organization, feeding and digestive system and other organ systems. Further, it will provide the description of mode of their reproduction and development and the information of their economic and ecological importance.</p>					
Learning Outcomes					
<p>On the completion of the course, the students will:</p> <ol style="list-style-type: none"> 1. Acquire the basic concepts of invertebrates with explanation of evolutionary origin and diversification. 2. Understand invertebrate organismal concepts in laboratory and field. 3. Demonstrate major evolutionary innovations for invertebrates with functional importance. 4. Understand how reproduction and development occurred and able to breed animals in the laboratory/field 5. Analyze economic and ecological importance of invertebrates. 					
Course Content				Assignments/Readings	
Week 1	Unit-1 Introduction 1.1. Classification of organisms 1.2. Definition, concept, evolutionary relationships and tree diagrams 1.3. Patterns of organization			{ Miller, S. A., & Harley, J. B. (2000). Zoology (4th, 5th, 6th, 10 th , 12 th ed) (International). Singapore: McGraw Hill. }	

<p>Week 2</p>	<p>Unit-2 Animal-Like Protists: The Protozoa</p> <ol style="list-style-type: none"> 2.1. Evolutionary perspective 2.2. Life within a single plasma membrane 2.3. Symbiotic lifestyles 2.4. Protozoan taxonomy: (up to phyla, subphyla and super classes) 2.5. Cilia and other pellicular structures 2.6. Nutrition 2.7. Genetic Control and reproduction 2.8. Symbiotic ciliates 2.9. Further phylogenetic considerations 	<p>{ Miller, S. A., & Harley, J. B. (2000). Zoology (4th, 5th,6th, 10th, 12th ed) (International). Singapore: McGraw Hill. }</p>
<p>Week 3</p>	<p>Unit-3 Multicellular and Tissue Levels of Organization</p> <ol style="list-style-type: none"> 2.1 Evolutionary perspective 2.2 Origins of multicellularity 2.3 Animal origins 2.4 Phylum porifera 2.5 Cell types, and skeletons 2.6 Body forms; maintenance functions, reproduction 	<p>{ Miller, S. A., & Harley, J. B. (2000). Zoology (4th, 5th,6th, 10th, 12th ed) (International). Singapore: McGraw Hill. }</p>
<p>Week 4</p>	<p>Unit-3 Multicellular and Tissue Levels of Organization</p> <ol style="list-style-type: none"> 2.7 Phylum cnidaria (coelenterata) the body wall and nematocyst 2.8 Alternation of generations; maintenance functions 2.9 Reproduction and classification up to class 2.10 Phylum ctenophore 2.11 Further phylogenetic considerations 	<p>{ Miller, S. A., & Harley, J. B. (2000). Zoology (4th, 5th,6th, 10th, 12th ed) (International). Singapore: McGraw Hill. }</p>
<p>Week 5</p>	<p>Unit-4 The Triploblastic, Acoelomate Body Plan</p> <ol style="list-style-type: none"> 4.1. Evolutionary perspective 4.2. Phylum platyhelminthes 4.3. Classification up to class 4.4. The free-living flatworms and the tapeworms 4.5. Phylum nemertea 4.6. Phylum gastrotricha 4.7. Further phylogenetic considerations. 	<p>{ Miller, S. A., & Harley, J. B. (2000). Zoology (4th, 5th,6th, 10th, 12th ed) (International). Singapore: McGraw Hill. }</p>
<p>Week 6</p>	<p>Unit 5</p>	<p>{ Miller, S. A., & Harley, J. B. (2000). Zoology (4th, 5th,6th,</p>

	<p>The Pseudo coelomate Body Plan: Aschelminths</p> <p>3.1. Evolutionary perspective 3.2. General characteristics 3.3. Classification up to phyla 3.4. Feeding and the Digestive System, other organ systems</p>	10th, 12 th ed) (International). Singapore: McGraw Hill. }
Week 7	<p>Unit 5</p> <p>The Pseudo coelomate Body Plan: Aschelminths</p> <p>3.5. Reproduction and Development of phylum 3.6. Phylum rotifera and phylum nematoda; phylum kinorhyncha 3.7. Some important nematode parasites of humans 3.8. Further phylogenetic considerations</p> <p>Unit 6</p> <p>Molluscan Success</p> <p>6.1 Evolutionary perspective: relationships to other animals 6.2 Origin of the coelom;</p>	{ Miller, S. A., & Harley, J. B. (2000). Zoology (4th, 5th,6th, 10th, 12 th ed) (International). Singapore: McGraw Hill. }
Week 8	<p>Unit 6</p> <p>Molluscan Success</p> <p>7.1. Molluscan characteristics; 7.2. Classification up to class 7.3. Characteristics of shell and associated structures, feeding, digestion, gas exchange, 7.4. Locomotion 7.5. Reproduction and development 7.6. Other maintenance functions and diversity in gastropods, 7.7. Bivalves and cephalopods 7.8. Phylogenetic considerations.</p>	{ Miller, S. A., & Harley, J. B. (2000). Zoology (4th, 5th,6th, 10th, 12 th ed) (International). Singapore: McGraw Hill. }
Week 9	Unit 7	{ Miller, S. A., & Harley, J. B. (2000). Zoology (4th, 5th,6th,

	<p>Annelida: The Metameric Body Form</p> <p>4.1 Evolutionary perspective 4.2 Relationship to other animals 4.3 Metamerism and tagmatization; 4.4 Classification up to class. 4.5 External structure and locomotion,</p>	10th, 12 th ed) (International). Singapore: McGraw Hill. }
Week 10	<p>Unit 7</p> <p>Annelida: The Metameric Body Form</p> <p>4.6 Feeding and the digestive system 4.7 Gas exchange and circulation 4.8 Nervous and sensory functions, excretion, regeneration, 4.9 Reproduction and development, in polychaeta, oligochaeta and hirudinea; 4.10 Further phylogenetic considerations</p>	{ Miller, S. A., & Harley, J. B. (2000). Zoology (4th, 5th,6th, 10 th , 12 th ed) (International). Singapore: McGraw Hill. }
Week 11	<p>Unit 8</p> <p>Arthropods: Blueprint for Success</p> <p>5.1 Evolutionary perspective 5.2 Classification and relationships to other animals 5.3 Metamerism and Tagmatization 5.4 The exoskeleton</p>	{ Miller, S. A., & Harley, J. B. (2000). Zoology (4th, 5th,6th, 10 th , 12 th ed) (International). Singapore: McGraw Hill. }
Week 12	<p>Unit 8</p> <p>Arthropods: Blueprint for Success</p> <p>5.5 Metamorphosis 5.6 Classification up to class 5.7 Further phylogenetic considerations</p>	{ Miller, S. A., & Harley, J. B. (2000). Zoology (4th, 5th,6th, 10 th , 12 th ed) (International). Singapore: McGraw Hill. }
Week 13	<p>Unit 9</p> <p>Hexapods and Myriapods: Terrestrial Triumphs</p> <p>6.1 Evolutionary perspective 6.2 Classification up to class 6.3 External structure and locomotion 6.4 Nutrition and the digestive system 6.5 Gas exchange</p>	{ Miller, S. A., & Harley, J. B. (2000). Zoology (4th, 5th,6th, 10 th , 12 th ed) (International). Singapore: McGraw Hill. }

	6.6 Circulation and temperature regulation	
Week 14	<p>Unit 9</p> <p>Hexapods and Myriapods: Terrestrial Triumphs</p> <p>6.7 Nervous and sensory functions</p> <p>6.8 Excretion</p> <p>6.9 Chemical regulation</p> <p>6.10 Reproduction and development in hexapoda</p> <p>6.11 Insect behavior</p> <p>6.12 Insects and humans</p> <p>6.13 Further phylogenetic considerations</p>	{ Miller, S. A., & Harley, J. B. (2000). Zoology (4th, 5th,6th, 10th, 12 th ed) (International). Singapore: McGraw Hill. }
Week 15	<p>Unit10</p> <p>Echinoderms</p> <p>10.1 Evolutionary perspective: relationships to other animals;</p> <p>10.2 Echinoderm characteristics; classification up to class. Maintenance functions, regeneration, reproduction, and development in asteroidea, ophiuroidea, echinoidea, holothuroidea and crinoidea</p>	{ Miller, S. A., & Harley, J. B. (2000). Zoology (4th, 5th,6th, 10th, 12 th ed) (International). Singapore: McGraw Hill. }
Week 16	<p>Unit10</p> <p>Echinoderms</p> <p>10.3 Further phylogenetic considerations</p> <p>10.4 Some lesser-known invertebrates: the lophophorates, entoprocts, cycliophores, and chaetognaths</p>	{ Miller, S. A., & Harley, J. B. (2000). Zoology (4th, 5th,6th, 10th, 12 th ed) (International). Singapore: McGraw Hill. }
Textbooks and Reading Material		
Campbell, N. A. (2002). Biology (6th ed). Menlo Park, California: Benjamin/Cummings Publishing Company, Inc.		
Hickman, C.P., Roberts, L.S., & Larson, A. (2004). Integrated principles of zoology (12th ed) (International). Singapore: McGraw Hill.		
Kent, G. C. & Miller, S. (2001). Comparative anatomy of vertebrates. New York: McGraw Hill.		

Miller, S. A., & Harley, J. B. (2000). Zoology (4th, 5th,6th, 10th, 12th ed) (International). Singapore: McGraw Hill.

Pechenik, J. A. (2000). Biology of invertebrates, (5th ed) (International). Singapore: McGraw Hill.

Teaching Learning Strategies

1. Discussion
2. Demonstration Method
3. Lecture Method
4. Project Method

Assignments: Types and Number with Calendar

1. Class presentation
2. written assignment
3. Case study.
4. 01 assignment before mid-term exam and 02 assignment after mid-term exam

Assessment

Sr. No.	Elements	Weightage	Details
1.	Midterm Assessment		
2.	Formative Assessment		
3.	Final Assessment		



Course Outline

Programme	BS Science Education	Course Code	SE-304L	Credit Hours	1
Course Title	Zoology Lab-II: Invertebrate Diversity (Classification, Phylogeny and Organization)				
Course Introduction					
<p>This course will provide hands on experience for learners. Students will get chance to interact with invertebrate members. Students will learn classification of each member of each phylum up to order level with adaptations in relation to habitat of the specimen. Preserved Specimen and or coloured projection slide and or CD ROM projection of computer will be used.</p>					
Learning Outcomes					
<p>On the completion of the course, the students will:</p> <ol style="list-style-type: none"> 1. Familiarized with the morphological and systematic knowledge about different principal representative classes of phylum in animals. 2. Learn about the general characters, structure, life history, classification and economic importance of different classes of phylum in animals. 					
Course Content				Assignments/Readings	
Week 1	1. Study of Euglena, Amoeba, Entamoeba, Plasmodium, Trypanosoma, Paramecium as representative of animal-like protists.			Practical Copy Preparation	
Week 2	1.1 Study of Euglena, Amoeba, Entamoeba, Plasmodium, Trypanosoma, Paramecium as representative of animal-like protists. (CONT.)			Practical Copy Preparation	
Week 3	2. Study of sponges and their various body forms.			Practical Copy Preparation	
Week 4	4.1 Study of sponges and their various body forms. (CONT.)			Practical Copy Preparation	

Week 5	3. Study of principal representative classes of phylum Coelentrata.	Practical Copy Preparation
Week 6	4. Study of principal representative classes of phylum Platyhelminthes.	Practical Copy Preparation
Week 7	4.1 Study of principal representative classes of phylum Platyhelminthes. (CONT.)	Practical Copy Preparation
Week 8	5. Study of representative of phylum Rotifera, phylum Nematoda.	Practical Copy Preparation
Week 9	5.1 Study of representative of phylum Rotifera, phylum Nematoda. (CONT.)	Practical Copy Preparation
Week 10	6. Study of principal representative classes of phylum Mollusca.	Practical Copy Preparation
Week 11	7. Study of principal representative classes of phylum Annelida	Practical Copy Preparation
Week 12	7.1 Study of principal representative classes of phylum Annelida. (CONT.)	Practical Copy Preparation
Week 13	8. Study of principal representative classes of phylum Arthropoda.	Practical Copy Preparation
Week 14	8.1 Study of principal representative classes of phylum Arthropoda. (CONT.)	Practical Copy Preparation
Week 15	8.2 Study of a representative of classes of phylum Echinodermata	Practical Copy Preparation
Week 16	8.3 Study of a representative of classes of phylum Echinodermata (CONT.)	Practical Copy Preparation

Textbooks and Reading Material

Hickman, C. P. & Kats, H. L. (2000). Laboratory studies in integrated principles of zoology. Singapore: McGraw Hill.

Miller, S. A. (2002). General zoology laboratory manual (5th ed) (International). Singapore: McGraw Hill.

Teaching Learning Strategies

1. Discussion
2. Demonstration Method
3. Lecture Method
4. Project Method

Assignments: Types and Number with Calendar

1. Class presentation
2. written assignment
3. 01 assignment before mid-term exam and 02 assignment after mid-term exam

Assessment

Sr. No.	Elements	Weightage	Details
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2.	Midterm Assessment		
3.	Formative Assessment		
4.	Final Assessment		

Course Code: SE-304A

Module Title: Mathematics A-II [Plane Curves & Analytic Geometry]

Module Rating: 4 Cr. Hours

Plane Analytic Geometry

- Conic section and quadratic equations
- Classifying conic section by eccentricity
- Translation and rotation of axis
- Properties of circle, parabola, ellipse, hyperbola
- Polar coordinates, conic sections in polar coordinates
- Graphing in polar coordinates
- Tangents and normal, pedal equations, parametric representations of curves

Applications of Integration

- Asymptotes.
- Relative extrema, points of inflection and concavity
- Singular, points, tangents at the origin
- Graphing of Cartesian and polar curves
- Area under the curve, area between two curves
- Arc length and intrinsic equations
- Curvature, radius and centre of curvature
- Involute and evolute, envelope

Analytic Geometry of Three Dimensions

- Rectangular coordinates system in a space
- Cylindrical and spherical coordinate system
- Direction ratios and direction cosines of a line
- Equation of straight lines and planes in three dimensions
- Shortest distance between skew lines
- Equation of sphere, cylinder, cone, ellipsoids, paraboloids, hyperboloids
- Quadric and ruled surfaces
- Spherical trigonometry. Direction of Qibla

Recommended Books

1. Thomas, *Calculus*, 11th Edition. Addison Wesley publishing company, 2005
2. H. Anton, I. Bevens, S. Davis, *Calculus*, 8th Edition, John Wiley & Sons, Inc. 2005
3. Hughes-Hallett, Gleason, McCallum, et al, *Calculus Single and Multivariable*, 3rd Edition. John Wiley & Sons, Inc. 2002.
4. Frank A. Jr, Elliott Mendelson, *Calculus*, Schaum's outlines series, 4th edition, 1999
5. C.H. Edward and E.D Penney, *Calculus and Analytic Geometry* Prentice Hall, Inc. 1988
6. E. W. Swokowski, *Calculus and Analytic Geometry* PWS Publishers, Boston, Massachusetts, 1983.
7. Dennis G. Zill & Patric D. Shanahan, *Complex Analysis*, Jones & Barlett Publishers, 2003

