INSTITUTE OF EDUCATION AND RESEARCH

University of the Punjab, Lahore
BS Science Education (1-8)

Course Outline

Programme	**BS Science Education (1-8)**	**Course Code**	**SE-307**	**Credit Hours**	3
Course Title	**Zoology III: Chordate Diversity (Classification, Phylogeny and Organization)**				

Course Introduction

This course will give understanding about the taxonomic characteristics of

Protochordates, chordates and the phylogenetic relationships of protochordates and various classes of chordates. It will develop critical thinking about phylogeny of chordates with respect to their physiological adaptations, behaviour and ecology.

Learning Outcomes

On the completion of the course, the students will:

1. Acquire the basic knowledge of taxonomic characteristics of chordates.
2. Understand the phylogenetic relations and diversity of Fish, amphibians, reptiles and mammals.
3. Analyze the process of micro evolution within chordates.
4. Demonstrate individually phylogentic relationships of chordates and their diversity.

	Course Content	**Assignments/Readings**
Week 1	**Unit-1** **Hemichordates and Invertebrate Chordates** 1.1. Evolutionary Perspective: Phylogenetic Relationships 1.2. Classification up to subphylum or class where applicable	{Miller, S. A., & Harley, J. B. (2000). Zoology (4th, 5th,6th, 10th ed) (International). Singapore: McGraw Hill.}
Week 2	**Unit-1** **Hemichordates and Invertebrate Chordates** 1.2. Classification up to subphylum or class where applicable 1.3. Further Phylogenetic Considerations.	{Miller, S. A., & Harley, J. B. (2000). Zoology (4th, 5th,6th, 10th ed) (International). Singapore: McGraw Hill.}
Week 3	**Unit-2** **Fishes: Vertebrate Success in Water** 2.1 Evolutionary perspective: phylogenetic relationships	{Miller, S. A., & Harley, J. B. (2000). Zoology (4th, 5th,6th, 10th ed) (International). Singapore: McGraw Hill.}
Week 4	**Unit-2** **Fishes: Vertebrate Success in Water** 2.2 Survey of super class agnatha and gnathostomata	{Miller, S. A., & Harley, J. B. (2000). Zoology (4th, 5th,6th,

		10th ed) (International). Singapore: McGraw Hill.}
Week 5	**Unit-2** **Fishes: Vertebrate Success in Water** 2.3 Evolutionary pressures: adaptations in locomotion, nutrition and the digestive system, circulation, gas exchange, nervous and sensory functions, excretion and osmoregulation, reproduction and development	{Miller, S. A., & Harley, J. B. (2000). Zoology (4th, 5th,6th, 10th ed) (International). Singapore: McGraw Hill.}
Week 6	**Unit-2** **Fishes: Vertebrate Success in Water** 2.4 Further phylogenetic considerations.	{Miller, S. A., & Harley, J. B. (2000). Zoology (4th, 5th,6th, 10th ed) (International). Singapore: McGraw Hill.}
Week 7	**Unit 3** **Amphibians: The First Terrestrial Vertebrates** 3.1. Evolutionary perspective: phylogenetic relationships 3.2. Survey of order caudata, gymnophiona, and anura	{Miller, S. A., & Harley, J. B. (2000). Zoology (4th, 5th,6th, 10th ed) (International). Singapore: McGraw Hill.}
Week 8	**Unit 3** **Amphibians: The First Terrestrial Vertebrates** 3.3. Evolutionary pressures: adaptations in external structure and locomotion, nutrition and the digestive system, circulation, gas exchange, temperature regulation, nervous and sensory functions, excretion and osmoregulation, reproduction, development, and metamorphosis 3.4. Further phylogenetic considerations.	{Miller, S. A., & Harley, J. B. (2000). Zoology (4th, 5th,6th, 10th ed) (International). Singapore: McGraw Hill.}
Week 9	**Unit 4** **Reptiles: The First Amniotes** 4.1 Evolutionary perspective: cladistic interpretation of the amniotic lineage 4.2 Survey of order testudines or chelonia, rhynchocephalia, squamata, and crocodilia;	{Miller, S. A., & Harley, J. B. (2000). Zoology (4th, 5th,6th, 10th ed) (International). Singapore: McGraw Hill.}

Week 10	**Unit 4** **Reptiles: The First Amniotes** 4.3 Evolutionary pressures: adaptations in external structure and locomotion, nutrition and the digestive system, circulation, gas exchange, and temperature regulation, nervous and	{Miller, S. A., & Harley, J. B. (2000). Zoology (4th, 5th,6th, 10th ed) (International). Singapore: McGraw Hill.}
	sensory functions, excretion and osmoregulation, reproduction and development 4.4 Further phylogenetic considerations.	
Week 11	**Unit 5** **Birds: Feathers, Flight, and Endothermy** 5.1 Evolutionary perspective: phylogenetic relationships	{Miller, S. A., & Harley, J. B. (2000). Zoology (4th, 5th,6th, 10th ed) (International). Singapore: McGraw Hill.}
Week 12	**Unit 5** **Birds: Feathers, Flight, and Endothermy** 5.2 Ancient birds and the evolution of flight; diversity of modern birds	{Miller, S. A., & Harley, J. B. (2000). Zoology (4th, 5th,6th, 10th ed) (International). Singapore: McGraw Hill.}
Week 13	**Unit 5** **Birds: Feathers, Flight, and Endothermy** 5.3 Evolutionary pressures: adaptation in external structure and locomotion, nutrition and the digestive system, circulation, gas exchange, and temperature regulation, nervous and sensory systems, excretion and osmoregulation, reproduction and development; migration and navigation.	{Miller, S. A., & Harley, J. B. (2000). Zoology (4th, 5th,6th, 10th ed) (International). Singapore: McGraw Hill.}
Week 14	**Unit 6** **Mammals: Specialized Teeth, Endothermy, Hair, and Viviparity** 6.1 Evolutionary perspective: diversity of mammals	{Miller, S. A., & Harley, J. B. (2000). Zoology (4th, 5th,6th, 10th ed) (International). Singapore: McGraw Hill.}

Week 15	**Unit 6** **Mammals: Specialized Teeth, Endothermy, Hair, and Viviparity** 6.2 Evolutionary pressures: adaptations in external structure and locomotion, nutrition and the digestive system, circulation, gas exchange, and temperature regulation	{Miller, S. A., & Harley, J. B. (2000). Zoology (4th, 5th,6th, 10th ed) (International). Singapore: McGraw Hill.}
Week 16	**Unit 6** **Mammals: Specialized Teeth, Endothermy, Hair, and Viviparity** 6.3 Evolutionary pressures: nervous and sensory functions, excretion and osmoregulation, behavior, reproduction and development.	{Miller, S. A., & Harley, J. B. (2000). Zoology (4th, 5th,6th, 10th 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 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

1. Class presentation
2. written assignment

Assessment

Sr. No.	Elements	Weightage	Details
1.	Midterm Assessment	35%	Written Assessment at the mid-point of the semester.
2.	Formative Assessment	25%	Continuous assessment includes: Classroom participation, assignments, presentations, viva voce, attitude and behavior, hands-on-activities, short tests, projects, practical, reflections, readings, quizzes etc.

3.	Final Assessment	40%	Written Examination at the end of the semester. It is mostly in the form of a test, but owing to the nature of the course the teacher may assess their students based on term paper, research proposal development, field work and report writing etc.

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Course Outline

Programme	BS Science Education	**Course Code**	SE-307A	**Credit Hours**	04
Course Title	**Mathematics A-III [Linear Algebra]**				

Course Introduction

Mathematics A-III [Linear Algebra] course introduces you to the fundamental concepts, techniques, and applications of linear algebra. Linear algebra is a branch of mathematics that deals with vectors, vector spaces, linear transformations, and systems of linear equations. It provides essential tools for solving problems in mathematics, science, engineering, computer science, economics, and more.

Learning Outcomes

On the completion of the course, the students will:

1. Enhance the problem-solving ability in Linear Algebra.

2. Develop the critical thinking of students about Matrices, Determinants and System of Linear Equations

Course Content

Week 1	**Unit -1: Matrices, Determinants and System of Linear Equations**
	1.1 Definition of matrix. various types of matrices
Week 2	1.2 Algebra of matrices x Determinant of square matrix, cofactors and minors
	1.3 Laplace expansion of determinants
Week 3	1.4 Elementary matrices, adjoint and inverses of matrices
	1.5 Rank of a matrix
Week 4	1.6 Introduction to systems of linear equations
	1.7 Cramer's rule, Guassian elimination and Gauss Jordan method
Week 5	1.8 Solution of homogenous and non-homogenous linear equations
	1.9 Net work flow problems
Week 6	**QUIZZ**
	QUIZZ
Week 7	**Unit-2: Vector Spaces**
	2.1 Real vector spaces, subspaces
Week 8	2.2 Linear combination and spanning set.

	2.3 Linear independence and linear dependence, basis and dimension, row space, Colum space and Null space
Week 9	**MID- TERM EXAM**
Week 10	**PRESENTATIONS**
Week 11	**Unit-3: Linear Transformations**
	3.1 Introduction to linear transformation
Week 12	3.2 Matrices of linear transformations
	3.3 Rank and nullity
Week 13	**QUIZZ**
	QUIZZ
Week 14	3.4 Eigen values and Eigen vectors
	3.5 Diagonalization
Week 15	3.6 Orthogonal diagonalization
	3.7 Orthogonal matrices, similar matrices
Week 16	**FINAL- TERM EXAM**

Textbooks and Reading Material

1. Howard Anton and Chris Rorres, Elementary Linear Algebra Applications Version, John Wiley and Sons Inc. 9th Edition, 2005
2. W. Keith Nicholoson, Elementary Linear Algebra, PWS-Kent Publishing Company, Boston, 2004
3. Bernard Kolman, David R. Hill, Introduction Linear Algebra with Applications, Prentice Hall International, Inc. 7th Edition, 2001
4. Stephen H. Friedberg Et al, Linear Algebra, Prentice Hall, Inc. 3rd Edition, 2000
5. Seymour Lipschutz, Theory and Problems of Beginning Linear Algebra, Schaum's Outline Series, Mc-Graw Hill Company, New York, 1997

Teaching Learning Strategies

- Lecture Method
- Collaborative Method
- Problem-Solving Approaches
- Demonstration Method
- Project Method
- Connecting mathematics to real world context Discussion

Assignments: Types and Number with Calendar
• Class presentation, Quizzes. • Ist assignment before mid-term exam. • 2nd assignment after mid-term exam

Assessment

Sr. No.	Elements	Weightage	Details
1.	Midterm Assessment	35%	Written Assessment at the mid-point of the semester.It will be a written test.
2.	Formative Assessment	25%	Continuous assessment includes: Classroom participation, assignments, presentations, viva voce, attitude and behavior, hands-on-activities, short tests, projects, practical, reflections, readings, quizzes etc.
3.	Final Assessment	40%	Written Examination at the end of the semester.It will be a written test.