Central University of Himachal Pradesh

(Established under Central Universities Act 2009
PO BOX: 21, DHARAMSHALA, DISTRICT KANGRA – 176215, HIMACHAL PRADESH
www.cuhimachal.ac.in

Semester – II

Course Code: ZOOL425
Course Name: Biostatistics

Credits Equivalent: 2

2 Credits (One credit is equivalent to 10 hours of lectures / organized classroom activity / contact hours; 5 hours of laboratory work / practical / field work / Tutorial / teacher-led activity and 15 hours of other workload such as independent individual/ group work; obligatory/ optional work placement; literature survey/ library work; data collection/ field work; writing of papers/ projects/dissertation/thesis; seminars, etc.)

Course Objectives:
CBB-403 will introduce the students to the concepts and methods of statistics, covering topics such as data organization, data presentation, data analysis, probability, estimation and hypothesis testing.

Attendance Requirement:
Students are expected to attend all lectures in order to be able to fully benefit from the course. A minimum of 75% attendance is a must failing which a student may not be permitted to appear in examination.

Evaluation Criteria:
1. Mid Term Examination: 25%
2. End Term Examination: 50%
3. Continuous Internal Assessment : 25%

- Assignment: 10%
- Class room participation: 10%
- Attendance: 5%

Course Contents:

Unit-I: Frequency Distributions and Graphs (3 Hrs)
Introduction to Statistics; Frequency Distributions; Dot Plots; Bar Charts or Bar Graphs; Histograms; Frequency Polygons; Stem-and-Leaf Displays or Plots; Time Series Graphs; Pie Graphs or Pie Charts; Pareto Charts

Unit-II: Numerical Measures (4 Hrs)
Measures of Central tendency:
Mean, Median, Mode - Notation and Formulae, Mean, Median and Mode for grouped data, relative merits of Mean, Median and Mode
Measures of Dispersion:

Range, Semi-interquartile range, Standard Deviation and Variance; Empirical Rule: The normal curve, Percentile and Quartile, Detecting Outliers

Unit-III: Correlation and Regression (3 Hrs)

Introduction to correlation; A numerical Index to Correlation; Pearson Product-Moment Correlation Coefficient; Interpretation of Correlation Coefficient: Explained and Unexplained Variation; Spearman Rank Correlation

Introduction to Regression; Criterion for the Line of Best Fit; Another Measure of Ability to Predict: The Standard Error of Estimate

Unit-IV: Probability (5 Hrs)

Introduction and Basic Concepts of Probability; Probability of Simple and Combined Events; Various Laws of Probability; Bayes' Theorem; Random Variables and their Distribution; Binomial Distribution; Normal Distribution; Interpreting Scores in Terms of z Score; Sampling Distribution; Central Limit Theorem

Unit-V: Statistical Inference (5 Hrs)

Principles of Hypothesis Testing; One and Two tailed tests; Type I and Type II errors; Significance; One Sample z-test; One Sample t-test; Two Sample z-test, Two Sample t-test; Chi-Square test; ANOVA

Reference Books

- Roger E. Kirk (2007) Statistics: An Introduction, Cengage Learning; 5th edition (ISBN-13: 978-0534564780)

- Neil A. Weiss (2012) Introductory Statistics , 9th edition (ISBN-13: 9780321691224)

- Charles Henry Brase and Corrinne Pellillo Brase Understandable Statistics: Concepts and Methods (2011) ISBN-10: 0840048386

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SEMESTER- II

Course Code: ZOOL 418
Credit: 02
Course Name: Functional Anatomy of chordates

UNIT-I

Origin and Classification of chordates

Integumentary system and its Derivatives

Development, general structure and functions of skin and its derivatives (Scales, horns, claws, nails, hoofs, feathers and hairs).

UNIT-II

Skeletal System

Jaw suspesnsorium & vertebral column

Limbs and girdles

Digestive System

General structure & Functions of Digestive System

Anatomy of alimentary canal in vertebrates

UNIT-III

Circulatory System

Blood and its composition

Evolution of heart and aortic arches

Respiratory System

Characters of respiratory tissue

Internal and external respiratory tissue

Comparative account of respiratory organs

UNIT-IV

Nervous system

Anatomy of the brain and spinal cord

Nerves-Cranial, Peripheral and autonomous nervous systems

Sense organs

Simple receptors, Organs of olfaction and taste

Lateral line system

UNIT-V

Anatomy of urinogenital system

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Semester II

Course Code: ZOOL 416
Credit: 02
Course Name: Cytogenetics and Evolution

UNIT-I Chromosome Organization

Structure of chromosomes, DNA packaging, Metaphase chromosomes, centromere, kinetochore, telomere and its importance
Heterochromatin and euchromatin
Giant chromosomes and Chromosome banding
 Sex determination and dosage compensation
Sex determination- in humans, Drosophila and other animals; dosage compensation of X-linked genes– hyperactivation of X-linked gene in male Drosophila, inactivation of X-linked genes in female mammals

UNIT-II Human cytogenetics

Human Karyotype and nomenclature of metaphase chromosome bands
Chromosome anomalies and disease caused by aneuploidy, deletion and duplication
Chromosomal anomalies in malignancy (chronic myeloid leukemia,
Burkitt's lymphoma, retinoblastoma and Wilms' tumour)

UNIT-III Quantitative and Population genetics

Quantitative traits, Polygenic inheritance and Heritability
Genes in populations
The Hardy-Weinberg law
Factors affecting allele frequencies in populations: Mutations, Migration, Natural selection, Random genetic drift and Genetic load.

UNIT-IV Origin and evolution of species

Biological species concept
Anagenesis and cladogensis
Speciation and its types: Allopatric, parapatric and sympatric
Gradualism and punctuated equilibrium
The shifting-balance Theory of Evolution

UNIT-V Molecular evolution:

Gene variation at molecular level
Homologous genes (Orthologous and paralogous genes)
Phylogenetic trees
Neutral theory of molecular evolution

Central University of Himachal Pradesh

SEMESTER- II

Course Code: ZOOL 425
Course Name: Bioinformatics
Course Instructor: Mr. Gagandeep Singh
Credits: 2
Credits Equivalent: 2 Credits (One credit is equivalent to 10 hours of lectures / organized classroom activity / contact hours; 5 hours of laboratory work / practical / field work / Tutorial / teacher-led activity and 15 hours of other workload such as independent individual/ group work; obligatory/ optional work placement; literature survey/ library work; data collection/ field work; writing of papers/ projects/dissertation/thesis; seminars, etc.)

Attendance Requirement:
Students are expected to attend all lectures in order to be able to fully benefit from the course. A minimum of 75% attendance is a must failing which a student may not be permitted to appear in examination

Evaluation Criteria:
1. Mid Term Examination: 25%
2. End Term Examination: 50%
3. Continuous Internal Assessment: 25%
a) Presentation 10%
b) Class Participation 10%
c) Attendance 5%

Course Contents:

UNIT - I: Introduction and Historical Background

- Introduction of Bioinformatics.
- Importance of Bioinformatics in Life Sciences
- Tools used in bioinformatics.

UNIT - II: Biological Databases

- Introduction
- Primary and Secondary Databases

- Nucleotide Sequence Databases
- Protein Sequence Databases (Swissprot, Uniprot)

UNIT - III: Introduction to Genomics and Proteomics

- Transcriptomics
- NGS data handling
- Amino acids and proteins

UNIT - IV: Phylogenetic Analysis

- Sequence alignment using bioinformatics tools
- BLAST and its types
- How to construct a tree

UNIT – V: Protein structure analysis

- Protein structure construction
- Secondary structure
- Tertiary structure
- Tertiary validation and visualization

Suggested Reading:

1. Bioinformatics: Sequence and Genome Analysis by David W. Mount.
2. Introduction to Bioinformatics by Arthur M Lesk.
3. Introduction to Bioinformatics by T K Attwood, D J Perry-Smith and Samiron Phukan.

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Course Code: ZOOL 417
Credit: 02
Course Name: Principles of Biochemistry

OBJECTIVES

The course has been designed to expose the students of Zoology to modern functional approach with prime object to understand the biochemical basis explaining the basic functioning of various body mechanisms. The attempt is to arrive at an approach that would necessarily involve biochemistry and help to solve mysteries of cellular activities.

UNIT- I Introduction:

Structure of atoms, molecules and chemical bonds
Stablizing interactions (Van der Waals, electrostatic, hydrogen bonding, hydrophobic interaction)
Principles of biophysical chemistry (pH, buffer, reaction kinetics, thermodynamics, colligative properties)

UNIT- II Carbohydrates: Structure and Function

General structure, classification and chemical properties of carbohydrates.
Isomerism in Glucose (Optical isomerism, Ring structure, Anomers & Epimers, Aldose & Ketose Isomerism)
Bioenergetics - glycolysis, oxidative phosphorylation

UNIT- III Amino acids and Proteins

Structure and classification of amino acids
Protein structure and function (Ramachandran plot, secondary structure, domains, motif and folds, Myoglobin, haemoglobin, etc)
Enzymes (Principles of catalysis, kinetic and regulation, isozymes), hormones and vitamins

UNIT- IV Lipids: Structure & Function

Definition and Nomenclature of fatty acids
Classification of fatty acids and lipids.
Saturated & Unsaturated fatty acids
Simple lipids: Triacylglycerols, waxes
Complex Lipids: Phospholipids, Glycolipids
Derived Lipids: Steroids, Lipoprotien, Prostaglandins

UNIT- V Nucleotides and Nucleic Acids

Nucleotides; building blocks of nucleic Acid
Conformation of nucleic acids (DNA, RNA, helix (A, B, Z), t-RNA,)
Proteins-nucleic acid interaction and Post-transcriptional modification

Recommended Books:
1. Zubay, G. 1988, biochemistry (2nd ed), Macmillan Publ. House N.Y.
2. Mahler, H.R. and codes F.H. 1971. Biological chemistry, Harper International.
3. Lehinger. A.L. 1978, Biochemistry Kalyani Publishers, Ludhiana
4. Goodwin T.W.a dn Meriar L.E.I. 1989 Introductory plant Biochemistry pergamon Press VY.
5. Conn, E.E. and Shimpap, P.K. 1976. Outlines of Biochemistry Wiley Eastern
6. Styer, Biochemistry.
7. Freifelder Molecular Biochemistry.