**INDEX**

**DEPARTMENT OF SCIENCE**

Bachelor of Science (Hons.) in Applied Life Sciences with Agrochemicals and Pest Management
**Semester-III**

## DISCIPLINE SPECIFIC CORE COURSE (DSC 03)

**Credit distribution, Eligibility and Pre-requisites of the Course**

| Course title & Code | Credits | Credit distribution of the core course | | | Eligibility criteria | Pre-requisite of the course (If any) |
|---|---|---|---|---|---|---|
| | | Lecture | Tutorial | Practical/ Practice | | |
| **Genetics and Molecular Biology ALS BOT DSC 03** | **4** | **2** | **0** | **2** | **XII pass with Science with Biology/ Biotechnology** | **NIL** |

**Learning Objectives:**

The learning objectives of this course are as follows:

- To understand the basic concept of Mendelian genetics and comprehensive study of Mendelian extensions.
- To provide adequate knowledge about Linkage, Crossing over and Mutations.
- To provide brief knowledge of population and evolutionary genetics.
- To impart detailed understanding about the structure of nucleic acids and their types. .
- To understand key events of Molecular biology comprising mechanism of DNA Replication, Transcription and Translation in Prokaryotes and Eukaryotes.
- To give comprehensive explanation of Transcriptional Regulation with examples of lac operon and tryptophan operon in prokaryotic as well as eukaryotic organisms along with the key concept of Gene Silencing.

**Learning Outcomes:**

By studying this course, students will be able to:

- Analyse the basic concepts of Mendelian genetics and its extension, Linkage and Crossing over, Mutations and population genetics.
- Explicate the mechanism of replication, transcription, translation in prokaryotes and eukaryotes.
- Comprehend the mechanism of gene regulation and gene silencing.

**Unit 1: Mendelian Genetics and Extensions (3 Hours)**

Mendel's work on transmission of traits, Co-dominance, Incomplete dominance, Multiple alleles, Lethal Genes, Epistasis, Pleiotropy, Polygenic inheritance, Pedigree analysis.

**Unit 2: Extra-chromosomal Inheritance (2 Hours)**

Cytoplasmic inheritance: Chloroplast variegation in Four 'O clock plant, Kappa particles in *Paramecium*, Maternal effect - shell coiling pattern in snail.

**Unit 3: Linkage, Crossing over and Chromosomal Mapping (3 Hours)**

Linkage and crossing over, Recombination mapping - two point and three points.

**Unit 4: Mutations (3 Hours)**

Chromosomal mutations, Deletion, Duplication, Inversion, Translocation, Aneuploidy and Polyploidy, Gene mutations.

**Unit 5: Population and Evolutionary Genetics (2 Hours)**

Allelic frequencies, Genotypic frequencies, Gene pool, Hardy-Weinberg Law.

**Unit 6: The Genetic Material: DNA and RNA (4 Hours)**

DNA structure: Salient features of double helix, Types of DNA, DNA denaturation and renaturation, Nucleosome, Chromatin structure- Euchromatin, Heterochromatin (Constitutive and Facultative), RNA structure and its types.

**Unit 7: Replication of DNA (3 Hours)**

Mechanism of prokaryotic DNA replication, Chemistry of DNA synthesis, Enzymes and proteins involved in DNA replication, Comparison of replication in prokaryotes and eukaryotes.

**Unit 8: Transcription and Processing of RNA (4 Hours)**

Mechanism of transcription in prokaryotes and eukaryotes, Split genes: concept of introns and exons, Removal of introns, Spliceosome machinery group I & group II intron splicing, alternative splicing, eukaryotic mRNA processing (5' cap, 3' poly A tail).

**Unit 9: Translation (3 Hours)**

Mechanism of translation in prokaryotes and eukaryotes: initiation, elongation and termination of polypeptides, Proteins and enzymes involved in translation.

**Unit 10: Regulation of transcription in prokaryotes and eukaryotes (3 Hours)**

Prokaryotes: Regulation of lactose metabolism and tryptophan synthesis in *E. coli*, Eukaryotes: Transcription factors, Heat shock proteins, Gene silencing.

**PRACTICAL (Credit: 02)**

**(Laboratory practical- 15 classes of 4 hours each)**

1. To study Mendelian and Non- Mendelian gene interaction ratios (9:7, 9:6:1, 13:3, 15:1, 12:3:1, 9:3:4) through seeds.
2. To study linkage, recombination, gene mapping using marker-based data from *Drosophila*.
3. Karyotype and Idiogram preparation through photographs.
4. PTC testing in a population and calculation of allelic and genotypic frequencies.
5. Study of abnormal human karyotype and pedigrees.
6. Isolation of genomic DNA from Cauliflower curd.
7. Qualitative analysis of DNA using gel electrophoresis.
8. Estimation of DNA by Diphenylamine method.
9. Separation of nucleotide bases by paper chromatography.
10. Purity and quantitative estimation of isolated DNA by UV-VIS spectrophotometer.

11. Study of Molecular techniques: PCR, Southern, Northern and Western Blotting and PAGE.

**Essential/ Recommended readings:**


1. Snustad D.P. and Simmon M.J. (2012) *Genetics* 6 th Ed., John Wiley & Sons. (Singapore)
2. Pierce B.A, (2012) *Genetics - A Conceptual Approach*, 4 th Ed., W.H. Freeman & Co. (New York)
3. Griffiths A.J.F., Wessler S. R, Carroll S. B and Doebley J. (2010) *An Introduction to Genetic Analysis*, 10th Ed., W.H. Freeman & Company (New York).
4. Watson J.D., Baker, T.A., Bell, S.P., Gann, A., Levine, M. and Losick, R. (2007) *Molecular Biology of the Gene*, 6th Ed. Pearson Benjamin Cummings, CSHL Press, New York, U.S.A.


**Suggestive readings:**


1. Klug, W.S., Cummings, M.R. and Spencer, C.A. (2009) *Concepts of Genetics*. 9th Ed. Benjamin Cummings. U.S.A.
2. Russell, P. J. (2010) *Genetics- A Molecular Approach*. 3rd Ed. Benjamin Cummings, U.S.A.


**Note:** Examination scheme and mode shall be as prescribed by the Examination Branch, University of Delhi, from time to time.

## DISCIPLINE SPECIFIC ELECTIVE COURSE (DSE 01)

**Credit distribution, Eligibility and Pre-requisites of the Course**

| Course title & Code | Credits | Credit distribution of the core course | | | Eligibility criteria | Pre-requisite of the course (if any) |
|---|---|---|---|---|---|---|
| | | Lecture | Tutorial | Practical/ Practice | | |
| Ecology, Conservation and Restoration ALS BOT DSE 01 | 4 | 2 | 0 | 2 | XII pass with Science with Biology/ Biotechnology | NIL |

**Learning Objectives:**

The learning objectives of this course are as follows:

- To develop a scientific understanding of the diverse aspects of ecology.
- To familiarize students with the interactions between the organisms and their physical environment.
- To understand various attributes of populations and communities with the help of theoretical concepts and field studies.
- To make students understand various factors that lead to variations among populations of a species.
- To familiarize students about the concepts of conservation and restoration.

**Learning Outcomes:**

By studying this course, students will be able to:

- Gain knowledge about the basic concepts of ecology.
- Comprehend the characteristics of the community, ecosystem development and climax theories.
- Explicate the relationship of evolution of various species and their environment.
- Analyse the basic field studies including data collection and its interpretation.
- Explicate the Conservation and Restoration methods.

**Unit 1: Introduction to Ecology** **(3 Hours)**

Autecology and Synecology, Laws of limiting factors, Study of physical factors: Temperature and Light.

**Unit 2: Population** **(4 Hours)**

Unitary and Modular populations, Unique and group attributes of population: density, natality, mortality, Life tables, Fecundity table, Survivorship curves, Intraspecific population regulation: density-dependent and independent factors.

**Unit 3: Species Interactions** **(5 Hours)**

Types of species interactions, Interspecific competition: Lotka-Volterra model of competition, Gause's Principle, Niche concept, Predation, Predator defence mechanisms.

**Unit 4: Community** **(4 Hours)**

Community characteristics: species richness, dominance, diversity, abundance, guilds, ecotone and edge effect, Ecological succession with examples and types.

**Unit 5: Ecosystem** **(5 Hours)**

Types of Ecosystems: terrestrial and aquatic ecosystems, Vertical stratification in tropical forest, Food chain: detritus and grazing food chains, linear and Y-shaped food chains, F ood web, Energy flow through the ecosystem: Ecological pyramids and Ecological efficiencies, Biogeochemical cycles: Nitrogen cycle.

**Unit 6: Conservation** **(5 Hours)**

Ecology in wildlife conservation and management: In-situ conservation (Biosphere Reserves, National Parks, Wildlife Sanctuaries), Ex-situ conservation (botanical gardens, gene banks, seed and seedling banks, DNA banks), Principles of Environmental impact assessment.

**Unit 7: Restoration** **(4 Hours)**

Restoration ecology: Afforestation, Social forestry, Agro-forestry, Joint Forest management, Role of remote sensing in management of natural resources.

**PRACTICAL** **(Credit: 02)**

**(Laboratory practical- 15 classes of 4 hours each)**

1. Study of life tables and plotting of survivorship curves of different types from hypothetical/real data.
2. Determination of population density and abundance in a natural or a hypothetical community by quadrat method.
3. Quantitative analysis of herbaceous vegetation in the college campus and comparison with Raunkiaer's Frequency distribution law.
4. Study of morphological features of hydrophytes and xerophytes in the ecosystems.
5. Measurement of temperature, turbidity/penetration of light and pH of any two water samples.
6. Comparison of Dissolved oxygen content in different water samples using Winkler's titration method.
7. Comparison of organic carbon of two soil samples using Walkley and Black's rapid titration method.
8. Comparison of $CO_2$ and alkalinity in two different water samples.
9. Estimation of Total Dissolved Solids (TDS) in water samples.
10. Perform Rapid field tests to detect the presence of Carbonates, Nitrate, Sulphate, Chloride, Organic matter and Base deficiency in two soil samples.
11. A visit to a National Park/Biodiversity Park/Wildlife Sanctuary/Urban Forest.

**Essential/Recommended readings:**

1. Sharma, P.D. (2012). *Ecology and Environment*. Rastogi Publications.
2. Singh J.S., Singh S.P., and Gupta S. R. (2014) *Ecology, Environment Science and Conservation*. S. Chand and Company Limited.
3. Odum, E.P. and Barrett G. W. (2004) *Fundamentals of Ecology*. Indian Edition (5th) Brooks/Cole Publishers.

**Suggestive readings:**

1. Smith T. M. and Smith R. L. (2015). *Elements of Ecology*. 9th International Edition, Publisher: Benjamin Cummings.
2. Saha G.K. and Mazumdar S. (2020) *Wildlife Biology*, An Indian Perspective.Publisher: PHI Learning Private Limited
3. Futuyma, Douglas and Mark, Kirkpatrick (2017). *Evolutionary Biology* (3rd Edition), Oxford University Press

**Note:** Examination scheme and mode shall be as prescribed by the Examination Branch University of Delhi, from time to time.

## DISCIPLINE SPECIFIC CORE COURSE (DSC 03)

**Credit distribution, Eligibility and Pre-requisites of the Course**

| Course title & Code | Credits | Credit distribution of the course | | | Eligibility criteria | Pre-requisite of the course (if any) |
|---|---|---|---|---|---|---|
| | | Lecture | Tutorial | Practical/ Practice | | |
| Organic Chemistry; ALS CHEM DSC 03 | 4 | 2 | 0 | 2 | XII pass with Science with Biology/ Biotechnology | NIL |

**Learning Objectives:**

The Learning Objectives of this course are as follows:

- To teach the fundamentals of organic chemistry.
- To introduce the basic concepts of stereochemistry of organic molecules.
- To familiarize students to different types of organic reactions.
- To inculcate the basics of reaction mechanism through different reactive intermediates.

**Learning Outcomes:**

By studying this course, students will be able to:

- Explain the relative behavior of organic compounds based on fundamental concepts learnt.
- Illustrate the mechanism of organic reactions by recalling and correlating the fundamental properties of the reactants involved.
- Differentiate between various types of organic reactions possible on the basis of reaction conditions.

**Unit 1: Basic Concepts** **(6 Hours)**

Electronic displacements and their applications: Inductive, electromeric, resonance (mesomeric) effects and hyperconjugation. Dipole moment, acidic and basic behaviour of organic molecules. Homolytic and heterolytic fission. Types, shape and relative stability of carbocations, carbanions and free radicals. Electrophiles and nucleophiles.

**Unit 2: Stereochemistry** **(10 Hours)**

Stereoisomerism: Concept of asymmetry and Optical activity, Chirality in molecules with one and two stereocentres. Fischer projection, enantiomers, diastereomers and meso structures. Specific rotation.

Configuration: CIP rules: Erythro/Threo, D/L and R/S designations.
Geometrical isomerism: *cis-trans, syn-anti* and *E/Z* notations.
Conformational Isomerism: Newmann, Sawhorse, Fischer and their interconversion.
Conformations, relative stability and energy diagrams of Ethane, Propane and butane. Relative stability of cycloalkanes (Baeyer strain theory), Cyclohexane conformations with energy diagram. Conformations of monosubstituted cyclohexanes.

**Unit 3: Types of Organic Reactions** **(10 Hours)**

Introduction to substitution, addition, elimination, rearrangement, oxidation and reduction reactions.
Nucleophilic substitution reactions-SN1 and SN2 mechanisms with stereochemical aspects and effect of solvent.
Elimination reactions: E1 and E2 mechanisms, Saytzeff, Hoffmann eliminations and Cope elimination. nucleophilic substitution vs. elimination.
Free radical substitutions: Halogenation of alkanes and concept of relative reactivity and selectivity.
Electrophilic addition reactions of alkenes and alkynes: mechanism with suitable examples, (Markownikov's/anti-Markownikov's addition), syn and anti-addition; addition of hydrogen, halogens, hydroboration-oxidation, ozonolysis and hydroxylation.

**Unit 4: Aromaticity** **(4 Hours)**

Concept of Aromaticity: Electrophilic aromatic substitutions (with their mechanism): halogenation, nitration, Friedel Crafts alkylation/ acylation, sulphonation. Orientation and reactivity in mono-substituted aromatic compounds.

**PRACTICAL** **(Credit: 02)**

**(Laboratory practical- 15 classes of 4 hours each)**

1. Purification of organic compounds by crystallization (from water and alcohol) and distillation.
2. Calibration of thermometer.

3. Criteria of purity: Determination of melting point.
4. Effect of impurity on the melting point.
5. Determination of boiling point of liquid compounds (boiling point lower than and more than 100 °C by distillation and inverse capillary method).
6. Detection of extra elements.
7. Separation of a mixture of two amino acids/sugars by radial/ascending paper chromatography.
8. Preparations (Mechanism of various reactions involved to be discussed):
    a. Bromination of phenol/aniline
    b. Benzoylation of phenol/aniline
    c. Nitration of nitrobenzene/toluene

The above derivatives should be prepared using 0.5-1 g of the organic compound. The solid samples must be collected and may be used for recrystallization and melting point.

**Essential/Recommended readings**


1. Mehta Bhupinder; Mehta Manju (2015), *Organic Chemistry***,** Second Edition, ISBN-978-81-203-5126-4, PHI Learning Pvt. Ltd. New Delhi.
2. Sykes, P.(2003), *A Guide Book to Mechanism in Organic Chemistry***,** 6th Edition Pearson Education.
3. Eliel, E. L. (2001), *Stereochemistry of Carbon Compounds*, Tata McGraw Hill.
4. Morrison, R. N.; Boyd, R. N., Bhattacharjee, S.K. (2010), *Organic Chemistry*, 7th Edition, Pearson Education.
5. Bahl, A; Bahl, B. S. (2019), *Advanced Organic Chemistry*, 22nd Edition, S. Chand.


**Suggestive readings**


1. Furniss, B.S.; Hannaford, A.J.; Smith, P.W.G.; Tatchell, A.R. (2012), *Vogel's Textbook of Practical Organic Chemistry*, Pearson.
2. Mann, F.G.; Saunders, B.C. (2009), *Practical Organic Chemistry*, Pearson Education.
3. Dhingra, S; Ahluwalia V.K., (2017), *Advanced Experimental Organic Chemistry*, Manakin Press.
4. Pasricha, S.; Chaudhary, A. (2021), *Practical Organic Chemistry: Volume I*, I K International Publishing House Pvt. Ltd., New Delhi.
5. Singh, J.; Awasthi, S. K.; Singh, Jaya. (2023) *Fundamentals of Organic Chemistry-III*, Pragati Prakashan.


**Note:** Examination scheme and mode shall be as prescribed by the Examination Branch, University of Delhi, from time to time.

## DISCIPLINE SPECIFIC ELECTIVE COURSE (DSE 01)

**Credit distribution, Eligibility and Pre-requisites of the Course**

| Course title & Code | Credits | Credit distribution of the course | | | Eligibility criteria | Pre-requisite of the course (if any) |
|---|---|---|---|---|---|---|
| | | Lecture | Tutorial | Practical/ Practice | | |
| Introduction to Heterocyclic Chemistry; ALS CHEM DSE 01 | 4 | 2 | 0 | 2 | XII pass with Science with Biology/ Biotechnology | NIL |

**Learning Objectives:**

The Learning objectives of this course are as follows:

- To teach students the fundamentals of heterocyclic chemistry.
- To make them familiar with classification and nomenclature of heterocyclic compounds.
- To study structural characteristics, physical properties, synthesis and chemical reactions of heterocyclic compounds.
- To know the importance of heterocyclic compounds.

**Learning Outcomes:**

By studying this course, students will be able to:

- Classify and name heterocyclic compounds.
- Analyze the important synthetic routes, physical properties, chemical properties and reactivity of five and six membered heterocyclic compounds.
- Explain the heterocyclic structures in biologically active compounds.
- Apply the study of heterocyclic compounds in medicine, agrochemicals, dyes and pigments, plastics and polymers.

**Unit 1: Introduction and Nomenclature (4 Hours)**

Introduction and classification of heterocyclic compounds. Nomenclature: Trivial names of common ring systems, Systematic (Hantzsch-Widman) nomenclature for heterocyclic compounds, naming of fused ring systems and Replacement nomenclature.

**Unit 2: General Properties and Synthesis of Five and Six Membered Heterocyclic Compounds (8 Hours)**

General discussion on the following aspects of five and six membered heterocyclic compounds containing one heteroatom: Structure, aromaticity, basicity, physical properties and general methods of synthesis of Furan, Pyrrole (Paal-Knorr synthesis, Knorr pyrrole synthesis, Hantzsch synthesis), Thiophene and Pyridine (Hantzsch synthesis).

**Unit 3: Reactions of Five and Six Membered Heterocyclic Compounds (10 Hours)**

Furan, Pyrrole, Thiophene: Orientation and reactivity towards electrophilic substitution reactions with mechanism.
Discussion on the following reactions: Nitration, sulphonation, halogenation, formylation, acylation, mercuration and carboxylation. Reactions exhibiting acidic/basic character. Oxidation, reduction and addition reactions. Diels-Alder reaction, reaction with diazonium salt.
Pyridine: Electrophilic substitution, nucleophilic substitution, oxidation and reduction reactions.

**Unit 4: Importance of Heterocyclic Compounds (8 Hours)**

Structure and importance of the following selected biologically active compounds to be discussed:
Heterocyclic Amino Acids: Proline, Hydroxyproline, Histidine, Tryptophan. Heterocyclic Vitamins; Niacin (Vitamin B3), Pyridoxine (Vitamin B6), Riboflavin (Vitamin B2), Thiamin (Vitamin B1) and Ascorbic acid (Vitamin C).
Pigments of Life: Hemoglobin and Chlorophyll.
Nucleic acids: Ribonucleic Acid (RNA) and Deoxyribonucleic Acid (DNA), Purines and Pyrimidines.

Structure and importance of the following selected Natural Products**:** Alkaloids, Marine Heterocycles, Halogenated Heterocycles, Macrocycles containing Oxazoles and Thiazoles, Anthocyanins and Flavones.

Structure and importance of heterocyclic compounds in Medicine, Agrochemicals, Dyes and pigments, Plastics and polymers.

**PRACTICAL (Credit: 02)**

**(Laboratory practical- 15 classes of 4 hours each)**

The following synthesis should be done by using 0.5-1 g of the organic compound. The solid samples must be collected and may be used for recrystallization and melting point.

1. Synthesis of oxygen containing heterocyclic compounds:
   (a) Phthalic anhydride (b) 7- Hydroxy-4-methylcoumarin
2. Synthesis of nitrogen containing heterocyclic compounds:
   (a) Phthalimide (b) Phthaloylglycine
3. Synthesis of Imidazole derivatives:
   (a) Benzimidazole (b) 2-Benzylbenzimidazole (c) 2-Methylbenzimidazole
4. Synthesis of Pyrazole derivatives:
   (a) 3-Methyl-2-pyrazolin-5-one (b) 3, 5-Dimethylpyrazole
5. Synthesis of Pseudothiohydantoin

**Essential/Recommended readings**


1. Mehta Bhupinder and Mehta Manju (2015) "*Organic Chemistry" 2nd Edn*., PHI Learning Pvt. Ltd. New Delhi. ISBN-978-81-203-5126-4.
2. Bansal Raj K "*Heterocyclic Chemistry" 5th Ed*, New Age International Publishers. ISBN 978-81-224-3143-8.
3. J. A. Joule, K. Mills and G. F. Smith, "*Heterocyclic Chemistry" 5th Edn.,* Wiley International Publications. ISBN: 978-1-4051-3300-5.
4. Thomas. L. Gilchrist "*Heterocyclic Chemistry" 3rd Edn.*, Prentice Hall Publication. ISBN 978-0-5822-7843-1.
5. R. M. Acheson "*An Introduction to the Chemistry of Heterocyclic compounds" 3rd Edn.,* Wiley India Pvt. Ltd. ISBN-13:978-8126516605.
6. I L Finar, "*Organic Chemistry" Vol. 1*, 6th Edn., Pearson Education. ISBN 10: 8177585428.
7. T. W. Graham Solomons, "*Organic Chemistry*" 12th Edn., John Wiley. ISBN-10: 1118133579.
8. Parashar, R. K.; Negi, B., "*Chemistry of Heterocyclic Compounds"*, 2015, Ane Books. ISBN-1466517131.


**Suggestive readings**


1. A.O. Fitton and R.K. Smalley, "*Practical Heterocyclic Chemistry"* 1st Edn., Academic Press. ISBN:9781483270791.

2. Furniss, B.S.; Hannaford, A.J.; Smith, P.W.G.; Tatchell, A.R. (2012), "*Vogel's Textbook of Practical Organic Chemistry"*, Pearson.

3. Mann, F.G.; Saunders, B.C. (2009), "*Practical Organic Chemistry*", Pearson.


**Note:** Examination scheme and mode shall be as prescribed by the Examination Branch, University of Delhi, from time to time.

## DISCIPLINE SPECIFIC CORE (DSC 03)

**Credit distribution, Eligibility and Pre-requisites of the Course**

| Course title & Code | Credits | Credit distribution of the course | | | Eligibility criteria | Pre-requisite of the course |
|---|---|---|---|---|---|---|
| | | Lecture | Tutorial | Practical/ Practice | | |
| Cell Biology and Biochemistry ALS ZOO DSC 03 | 4 | 2 | 0 | 2 | XII pass with Science with Biology/ Biotechnology | NIL |

**Learning Objectives:**

The learning objectives of this course are as follows:

- To understand structure and functions of various cellular compartments and cell organelles.
- To learn about cell-cycle and its regulation.
- To acquire the knowledge of biomolecules and metabolic pathways.
- To study about enzyme action.

**Learning Outcomes:**

By studying this course, students will be able to:

- correlate the structure of various cell components with their function.
- describe the metabolic fate of carbohydrates, proteins and fats and understand the mechanics of enzyme action.

**Unit 1: Basic structure of cell and cell organelles (12 Hours)**

Prokaryotic and eukaryotic cells. Structure of cell membrane: various models, fluidity of membrane. Eukaryotic cell organelles: Mitochondria, Chloroplast, Endoplasmic reticulum, Golgi body and Lysosomes. Nucleus: Nuclear Envelope- structure of nuclear pore complex, chromatin- euchromatin and heterochromatin; DNA packaging in eukaryotes.

**Unit 2: Cell Cycle** **(3 Hours)**

Cell division**:** Mitosis and Meiosis. Regulation of cell cycle.

**Unit 3: Biomolecules and Metabolic pathways** **(11 Hours)**

Introduction to Biomolecules: Carbohydrates, Lipids, and Proteins. Glycolysis, Kreb's Cycle, Pentose phosphate pathway, Gluconeogenesis, Glycogen Metabolism. β oxidation of palmitic acid. Transamination, Deamination and Urea Cycle.

**Unit 4: Enzyme action and regulation** **(4 Hours)**

Mechanism of action (induced fit theory), Enzyme Kinetics (Michaelis Menten equation for single enzyme single substrate reactions), Enzyme inhibition and regulation.

**PRACTICAL** **(Credit: 02)**

**(Laboratory practical- 15 classes of 4 hours each)**

1. Preparation of a temporary stained squash of onion root tip and to study various stages of mitosis.
2. Study of various stages of meiosis through permanent slides.
3. Cytochemical demonstration of DNA by Feulgen reaction.
4. Perform qualitative tests to identify functional groups of carbohydrates in given solutions (Glucose, Fructose, Sucrose, Lactose)
5. Study of activity of salivary amylase under optimum conditions.
6. Separation and identification of amino acids by paper chromatography

**Essential/Recommended readings**


1. Becker, Kleinsmith, and Hardin (2018) *The World of the Cell*, IX Edition, BenjaminCummings Publishing, San Francisco.
2. Karp, G. (2015). *Cell and Molecular Biology: Concepts and Experiments*, VIII Edition, John Wiley & Sons Inc.
3. Berg, J. M., Tymoczko, J. L. and Stryer, L. (2015) *Biochemistry*. VII Edition. W.H Freeman and Co.
4. Nelson, D. L., Cox, M. M. and Lehninger, A.L. (2009). *Principles of Biochemistry*. IV Edition. W.H. Freeman and Co.

**Suggestive readings**


1. Cooper, G.M., Hausman, R.E. (2019) *The Cell: A Molecular Approach*. VIII Edition, ASM Press and Sinauer Associates.
2. Murray, R.K., Granner, D.K., Mayes, P.A. and Rodwell, V.W. (2009). *Harper's Illustrated Biochemistry*. XXVIII Edition. Lange Medical Books/Mc Graw3Hill.


**Note:** Examination scheme and mode shall be as prescribed by the Examination Branch, University of Delhi, from time to time.

## DISCIPLINE SPECIFIC ELECTIVE COURSE (DSE 01)

**Credit distribution, Eligibility and Pre-requisites of the Course**

| Course title & Code | Credits | Credit distribution of the course | | | Eligibility criteria | Pre-requisite of the course |
|---|---|---|---|---|---|---|
| | | Lecture | Tutorial | Practical/ Practice | | |
| **Biostatistics and Bioinformatics ALS ZOO DSE 01** | **4** | **2** | **0** | **2** | **XII pass with Science with Biology/ Biotechnology** | **NIL** |

**Learning Objectives:**

The learning objectives of this course are as follows:

- To acquaint the students of the application of statistical methods for analysing the biological data.
- To impart the theoretical and practical knowledge of biological databases and use of various software for their analysis.

**Learning Outcomes:**

By studying this course, students will be able to:

- use statistical formulae for analyzing data.
- apply statistical tests like Chi-square tests, Z-test and t- test etc. for testing hypothesis.
- Use different biological databases and bioinformatic tools.

**Unit 1: Introduction to Biostatistics (2 Hours)**

Definition, Aim and Scope, Applications and limitations of biostatistics.

**Unit 2: Measures of Central Tendency and Dispersion (6 Hours)**

Mean, Median and Mode; Variance, Standard deviation, Standard error, Co-efficient of Variance.

**Unit 3: Testing of Hypothesis and Statistical Tests (7 Hours)**

Type-I and Type-II errors; Confidence Intervals and Confidence Levels, Chi-square test, Z-test and t-test.

**Bioinformatics**

**Unit 4: Introduction to Bioinformatics (3 Hours)**

Historical background, Aims and scope, Bioinformatics in Genomics, Transcriptomics, Proteomics, Metabolomics, Systems biology, Applications and Limitations in bioinformatics.

**Unit 5: Biological Databases (5 Hours)**

Introduction to biological databases; Primary, secondary and composite databases; Nucleic acid databases (GenBank, DDBJ, EMBL and NDB); Protein databases (PIR, SWISS-PROT, TrEMBL, PDB).

**Unit 6: Basic Concepts of Sequence Alignment (7 Hours)**

Scoring Matrices (PAM, BLOSUM), Methods of Alignment (Dot matrix, Dynamic Programming, BLAST and FASTA); Local and global alignment, pair wise and multiple sequence alignments; Similarity, identity and homology of sequences.

**PRACTICAL (Credit: 02)**

**(Laboratory practical- 15 classes of 4 hours each)**

**Part - A Biostatistics**

1. To compute Coefficient of Variance from samples provided.
2. To collect data on different parameters of animal samples and test significant difference between means ( Z-test, t-test).
3. To compute 'test of independence' and test for 'goodness of fit' with samples/data provided.
4. To learn graphical representations of statistical data with the help of computers (e.g. MS Excel).

**Part - B Bioinformatics**

1. To learn about biological databases and their characteristics.
2. To retrieve nucleotide and protein sequences from the databases.
3. To perform pair-wise alignment of sequences (BLAST).
4. To perform multiple sequence alignment (Clustal X)

**Essential/Recommended readings**


1. Ghosh Z and Mallick B. (2008). Bioinformatics: *Principles and Applications*, Oxford University Press.
2. Pevsner J. (2009). *Bioinformatics and Functional Genomic*s, II Edition, Wiley Blackwell.
3. Zar, Jerrold H. (1999). *Biostatistical Analysis*, IV Edition, Pearson Education Inc and Dorling Kindersley Publishing Inc. USA


**Suggestive readings**


1. Zvelebil, Marketa and Baum O. Jeremy (2008. *Understanding Bioinformatics*, Garland Science, Taylor and Francis Group, USA.

2. Antonisamy, B., Christopher S. and Samuel, P. P. (2010). *Biostatistics: Principles and Practice*. Tata McGraw Hill Education Private Limited, India.

3. Pagana, M. and Gavreau, K. (2000). *Principles of Biostatistics,* Duxberry Press, USA


**Note:** Examination scheme and mode shall be as prescribed by the Examination Branch, University of Delhi, from time to time.