

Agriculture and Forestry University
Office of Service Commission

Subject : Biochemistry

1. Introduction to Biochemistry

- 1.1. Introduction, scope and application of biochemistry
- 1.2. Structure of cell, cell organelles and their biochemical functions, transport across cell membrane
- 1.3. Structure and properties of water, ionization of water, PH, Henderson, Hasselbalch equation and biological importance of buffers.
- 1.4. Thermodynamics of the cell, biochemical reactions.

2. Biomolecules

- 2.1. Classification, structure, properties and functions of amino acid
- 2.2. Classification, structure, properties and functions of proteins, purification and sequencing of proteins
- 2.3. Classification, structure, properties and functions of carbohydrates, biological significance of monosaccharide, oligosaccharides and polysaccharides.
- 2.4. Classification, structure, properties and functions of lipids. Properties of fatty acid, TAG. Structure and functions of essential fatty acids, phospholipids, glycolipid and cholesterol. Structure and functions of prostaglandins and bile acids.
- 2.5. Nucleic acids-nucleotides, nucleosides, structure of DNA, types of RNA, replication of DNA both in prokaryotes and eukaryotes. Transcription of RNA nboth in prokaryotes and eukaryotes, genetic codes
- 2.6. Identification and estimation of different biomolecules.
- 2.7. Biosynthesis and degradation of nucleotides, DNA technology in biochemical concept.

3. Enzymes

- 3.1 Nomenclature, classification of enzyme catalyzed reactions, properties of enzymes
- 3.2 Factors affecting enzyme activity
- 3.3 Application of enzymes, coenzymes
- 3.4 Mechanism of enzyme action and kinetics of enzyme

4. Vitamins and minerals

- 4.1 Metabolic role of vitamins in coenzymes formation
- 4.2 Functions, dietary sources, RDA and abnormality associated with fat soluble vitamins.
- 4.3 Functions, dietary sources, RDA and abnormality associated with water soluble vitamins
- 4.4 Functions, dietary sources, RDA and abnormality associated with macro minerals
- 4.5 Functions, dietary sources, RDA and abnormality associated with micro minerals

5 Metabolism

5.1 Overview of metabolism

5.2 Carbohydrate metabolism: glycolysis and BPG shunt. TCA cycle and amphibolic role, gluconeogenesis, glycogenesis, glycogenolysis, HMP shunt, galactose metabolism and lactose synthesis, glucuronic acid pathway, carbohydrate biosynthesis in plants or agricultural crops

5.3 Lipid metabolism: β -oxidation of fatty acid, biosynthesis of fatty acid. TAG biosynthesis and degradation. ketone bodies synthesis and degradation, lipoprotein metabolism

5.4 Protein Metabolism: amino acid biosynthesis, degradation of amino acids (transaminatin, deamination, decarboxylation) protein synthesis and urea cycle

5.5 Integration of metabolism

5.6 Biological oxidation: enzymes involve in biological oxidation, biological oxidation and electron transport chain, oxidative phosphorylation, mechanism of oxidative phosphorylation, inhibitors of ETC and oxidative phosphorylation.

6 Hormones

6.1 Definitions of hormones and classification of plant hormones

6.2 Metabolic functions of plant hormones

6.3 Discovery, characterization, movement in the plant and physiological effects of Auxin, Gibberellins, Cytokinins, Abscisic acid and Ethylene

7 Nutritional Biochemistry

7.1 Calorimetry, BMR, SDA, RQ

7.2 Carbohydrate, protein and fat malnutrition

7.3 Food additives and naturally occurring toxic substance in food

7.4 Dietary factors in carcinogenesis, free radical and anti oxidant, pro-oxidants

8 Secondary metabolites

8.1 Introduction, classification and metabolic roles of secondary metabolites in agricultural crops

8.2 Synthesis and industrial application of secondary metabolites.

9 Biochemical Techniques

9.1 Electrophoresis, chromatography, centrifugation

9.2 Spectrophotometry and colorimetry, ELISA, auto analyzer

9.3 PCR, RAPD, RFLP

9.4 Gene interactions and epistasis

9.5 Linkage, crossing over, recombination and gene mapping

9.6 DNA and its structure, DNA replication, transcription, translation and expression

9.7 Protein and gene regulation

9.10 Introduction, history and importance of animal breeding

- 9.11 Anima genetic resources and sustainable development
 - 9.12 Importance of indigenous breed and economic values
 - 9.13 Rare breeds of different species of animals and their characteristics
 - 9.14 Reasons for being endangered, strategies for conservation
 - 9.15 Variation causes of variation
 - 9.16 Importance of heredity and environment
 - 9.17 Gene action (additive and non-additive)
 - 9.18 Concept of heritability and repeatability
 - 9.19 Selection (principles, basis, method, selection parameters): phenotypic and genomic selection and its accuracy
 - 9.20 Livestock breeding system, its implication in enhancing productivity of different species, breeding herd management
 - 9.21 Important economic traits of livestock and poultry
 - 9.22 Breeding values, dominance and epistatic values
 - 9.23 Inbreeding: coefficient of inbreeding and relationship, measure of inbreeding and relationship, resemblance among relative.
 - 9.24 Development of breeds, strain, lines and family
 - 9.25 Livestock breeding plan: goals, objectives, and outcomes
 - 9.26 Livestock breeding policy in Nepal
- 10 Animal reproduction, molecular biology and biotechnology
- 10.1 Concept of growth and development
 - 10.2 Growth and thermal environment
 - 10.3 Hormonal mechanism in growth and lactation
 - 10.4 Hormonal mechanism in reproduction
 - 10.5 Male and female reproductive system
 - 10.6 Estrus detection and estrus cycle
 - 10.7 Estrus introduction and estrus synchronization
 - 10.8 Ovulation
 - 10.9 A.I. Introduction, advantage and limitation of A. I.
 - 10.10 Techniques of AI
 - 10.11 Method of semen collection
 - 10.12 Dilution, preservation, thawing, transportation of semen
 - 10.13 Embryo transfer, importance, techniques
 - 10.14 Super ovulation, collection, synchronization
 - 10.15 Transfer of embryo
 - 10.16 Introduction of basic molecular biology
 - 10.17 Isolation of DNA and RNA, radio-labeling of nucleic acids
 - 10.18 Nucleic acid hybridization, gel electrophoresis
 - 10.19 DNA sequencing
 - 10.20 Restriction enzymes, DNA modifying enzymes and DNA ligase
 - 10.21 Host cell types, plasmid, bacteriophage and other vectors

- 10.22 Cloning strategies: cloning from mRNA, genomic DNA
- 10.23 Expression of cloned genes
- 10.24 The polymerase chain reaction
- 10.25 Selection, screening and analysis of recombinants
- 10.26 Analysis of gene structure and function, making proteins
- 10.27 Transformation of genes
- 10.28 Transgenic animal production and its role in genetic improvement
- 10.29 Molecular breeding approaches in domestic animals
- 10.30 Recent advances in AI, ET, NT
- 10.31 Genetic principle of diseases resistance and gene therapy
- 10.32 Animal biotechnology in Nepal
- 10.32 Genetic progress achieved through biotechnological approaches