SYLLABUS: NUTRITION

PAPER I: GENERAL PAPER

(Short answer Questions)

Basic research methodology, statistics, general biology and nutrition

PAPER II: SUBJECT-SPECIFIC

(Short answer Questions)

Students need to apply to any one of the 3 subjects

Nutritional biochemistry

OR

Human nutrition

OR

Molecular nutrition

The syllabus for the subjects is provided below

NUTRITIONAL BIOCHEMISTRY

1. Carbohydrates: glucose and glycogen metabolism; gluconeogenesis; pentose phosphate pathway; glycoproteins; and proteoglycans
2. Proteins: amino acid metabolism; protein structure, synthesis and degradation
3. Lipids: fatty acids and triacylglycerol metabolism, different lipids and their metabolism
4. Regulation of carbohydrate, protein and lipid metabolism
5. Bioenergetics: energy rich components, mitochondrial energy metabolism-electron transport chain, oxidative phosphorylation, mitochondrial transport mechanisms
6. Nucleic acids: purine and pyrimidine metabolism
7. Enzyme, mechanism of enzyme catalysis and enzyme kinetics
8. Hormones: mechanism of action, signal transduction
9. Techniques in nutritional biochemistry and recent advances: stable isotope techniques, metabolomics, and chromatography

HUMAN NUTRITION

1. **Nutrition through life cycle**
   Growth and development from conception to elderly
   Nutritional needs and dietary guidelines for adequate nutrition throughout the life cycle
   Methods for assessing nutritional requirements
   Factors affecting the nutritional requirements

2. **Carbohydrates**
   Classification/Types
   Metabolism, Utilization & Absorption
   Functions

3. **Proteins**
   Classification/Types
   Metabolism, Utilization & Absorption
   Functions

4. **Lipids**
   Classification/Types
   Metabolism, Utilization & Absorption
   Functions

5. **Water**
   Compartments of body water and water balance
   Disturbances of water balance

6. **Micronutrients**
   Sources, Functions
   Requirements, Absorption, Utilization, Bioavailability and Toxicity

7. **Energy**
   Computing energy expenditure and energy balance
   Estimation of energy requirements
   Factors affecting Energy expenditure & requirement

8. **Nutritional Assessment**
   Methods of nutritional assessment
   Growth standards
   Impact of altered nutrition on growth & development
   Changes in body composition through lifecycle
   Techniques in the assessment of body composition

9. **Medical nutrition therapy in clinical conditions**
   Etiology, pathophysiology of clinical conditions
   Nutritional requirements and nutritional therapy plan

MOLECULAR NUTRITION

1. MOLECULES AND THEIR INTERACTIONS

- Conformation of nucleic acids (helix (A, B, Z), t-RNA, micro-RNA).
- Stabilizing interactions (Van der Waals, electrostatic, hydrogen bonding, hydrophobic interaction, etc.).
- Principles of biophysical chemistry (pH, buffer, reaction kinetics, thermodynamics, colligative properties).
- Stability of proteins and nucleic acids.

2. CELLULAR ORGANIZATION

- Organization of genes and chromosomes (Operon, unique and repetitive DNA, interrupted genes, gene families, structure of chromatin and chromosomes, heterochromatin, euchromatin, transposons).

3. FUNDAMENTAL PROCESSES

- DNA replication, repair and recombination (Unit of replication, enzymes involved, replication origin and replication fork, fidelity of replication, extrachromosomal replicons, DNA damage and repair mechanisms, homologous and site-specific recombination).
- RNA synthesis and processing (transcription factors and machinery, formation of initiation complex, transcription activator and repressor, RNA polymerases, capping, elongation, and termination, RNA processing, RNA editing, splicing, and polyadenylation, structure and function of different types of RNA, RNA transport).
- Control of gene expression at transcription and translation level (regulating the expression of phages, viruses, prokaryotic and eukaryotic genes, role of chromatin in gene expression and gene silencing)

4. CELL COMMUNICATION AND CELL SIGNALLING

- Cell signalling Hormones and their receptors, cell surface receptor, signalling through G-protein coupled receptors, signal transduction pathways, second messengers, regulation of signalling pathways, bacterial and plant two component systems, light signalling in plants, bacterial chemotaxis and quorum sensing.

5. DEVELOPMENTAL BIOLOGY

- Basic concepts of development: Potency, commitment, specification, induction, competence, determination and differentiation; morphogenetic gradients; cell fate and cell lineages; stem cells; genomic equivalence and the cytoplasmic determinants; imprinting; mutants and transgenics in analysis of development.
- Gametogenesis, fertilization and early development: Production of gametes, cell surface molecules in sperm-egg recognition in animals; embryo sac development and double fertilization in plants; zygote formation, cleavage, blastula formation, embryonic fields, gastrulation and formation of germ layers in animals

6. MOLECULAR PHYSIOLOGY

- Molecular and functional organization of a cell and its sub-cellular components; principles of homeostasis; intercellular communication; apoptosis; transport mechanisms across cell membranes

- Blood and circulation - Blood corpuscles, haemopoiesis and formed elements, plasma function, blood volume, blood volume regulation, blood groups, haemoglobin, immunity, haemostasis
- Endocrinology and reproduction - Endocrine glands, basic mechanism of hormone action, hormones and diseases; reproductive processes, gametogenesis, ovulation, neuroendocrine regulation
- Molecular basis of muscle contraction in skeletal and in smooth muscles; energy source and muscle metabolism; physiology of digestion and absorption of nutrients; metabolic and endocrine consequences of obesity & metabolic syndrome; Stress response.

7. INHERITANCE BIOLOGY

- Concept of gene: Allele, multiple alleles, pseudoallele

8. APPLIED BIOLOGY

- Tissue and cell culture methods for animals.
- Genomics and its application to health.

9. METHODS IN BIOLOGY

a. Molecular Biology and Recombinant DNA methods

- Isolation and purification of RNA, DNA (genomic and plasmid) and proteins, different separation methods.
- Analysis of RNA, DNA and proteins by one- and two-dimensional gel electrophoresis.
- DNA sequencing methods, strategies for genome sequencing.
- Methods for analysis of gene expression at RNA and protein level, large scale expression, such as micro array-based techniques

b. Biophysical Method

- Molecular analysis using UV/visible spectroscopy.

c. Microscopic techniques

- Visualization of cells and subcellular components by light microscopy, resolving powers of different microscopes, microscopy of living cells, scanning and transmission microscopes, image processing methods in microscopy.