

## Department of Agricultural Biochemistry

### M.Sc. Programme

Course No.	Title of the course	Credits
<b>1<sup>st</sup> Semester</b>		
ABC-501	Basic Biochemistry	3+1
ABC-502	Enzymology	3+1
ABC-503	Food and Nutritional Biochemistry	3+1
<b>2<sup>nd</sup> Semester</b>		
ABC-551	Molecular Biology	3+1
ABC-552	Techniques in Biochemistry I (Theoretical Aspects)	2+0
ABC-553	Plant Biochemistry I	3+0
<b>3<sup>rd</sup> Semester</b>		
ABC-601	Intermediary Metabolism	3+0
ABC-602	Carbon Nitrogen and Sulphur Metabolism	3+1
ABC-649	Seminar-I	1+0
<b>4<sup>th</sup> Semester</b>		
ABC-699	Seminar-II	1+0
ABC-700	Master's Research	0+20

### **ABC 501 Basic Biochemistry**

**3+1**

#### **Theory**

Scope and importance of biochemistry in agriculture; Fundamental principles governing life; structure of water; acid base concept and buffers; pH; hydrogen bonding; hydrophobic, electrostatic and Van der Waals forces.

Classification, structure and function of carbohydrates, lipids and biomembranes, amino acids, proteins, and nucleic acids.

Structure and biological functions of vitamins & Plant Hormones, Bioenergetics.

#### **Practical**

Preparation of standard and buffer solutions, Extraction and estimation of sugars, Amino acids, Estimation of Proteins by Lowry's method, Estimation of DNA and RNA by diphenylamine and orcinol methods, Estimation of Ascorbic acid, Separation of biomolecules by TLC and Paper chromatography.

### **ABC 502 Enzymology**

**3+1**

#### **Theory**

Introduction and historic perspective, Enzyme nomenclature and classification, measurement of enzyme activity. Ribozymes isozymes & zymogens. Enzyme structure, enzyme specificity, active site, mechanism of enzyme catalysis. cofactors, coenzymes - their structure and role. Enzyme kinetics, enzyme inhibition and activation, multienzyme complexes, allosteric enzymes and their kinetics, regulation of enzyme activity. Isolation and purification of enzymes, enzyme immobilization.

### **Practical**

Enzyme assay by taking any model enzyme, study of the effect of enzyme and substrate concentrations and determination of  $K_m$  and  $V_{max}$ , determination of pH and temperature optima and effect of various inhibitors, determination of the pH and temperature stability of enzyme.

## **ABC 503 Food and Nutritional Biochemistry**

**3+1**

### **Theory**

Fundamentals of human nutrition, concept of balanced diet, biochemical composition, energy and food value of various food grains (including cereals, pulses, oilseeds), fruits and vegetables. Physico-chemical, functional and nutritional characteristics of carbohydrates, proteins and fats and their interactions (emulsions, gelation, browning etc.).

Biochemical and nutritional aspects of vitamins, minerals, Nutraceuticals, antinutritional factors.

Effect of cooking, processing and preservation of different food products on nutrients, biochemical aspects of food spoilage, role of lipase and lipoxygenase, oxidative rancidity and antioxidants.

Enzymes in food industry, food additives (coloring agents, preservatives etc.), nutritional quality of plant, dairy, poultry and marine products.

### **Practical**

Estimation of starch, lipid/oil, phenols in plant tissue/sample, Estimation of carotenoids, Estimation of Vitamin C in fruits, Reducing & non reducing sugar in fruits, Estimation of protein contents, Determination of limiting amino acids, Estimation of Phytate/Oxalate.

## **ABC 551 Molecular Biology**

**3+1**

### **Theory**

Historical development of molecular biology, nucleic acids as genetic material, chemistry and structure of DNA and RNA, Genome organization in prokaryotes and eukaryotes, chromatin structure and function.

DNA replication, DNA polymerases, topoisomerases, DNA ligase, reverse transcriptase, repetitive and non-repetitive DNA, satellite DNA; transcription process, RNA editing, RNA processing.

Ribosomes structure and function, organization of ribosomal proteins and RNA genes, genetic code, aminoacyl tRNA synthases, inhibitors of replication, transcription and translation; translation and Post translational modification; nucleases and restriction enzymes, regulation of gene expression in prokaryotes and eukaryotes, molecular mechanism of mutation.

### **Practical**

Isolation and purification of DNA and RNA from different sources, check of purity of isolated DNA and RNA, restriction fragmentation and separation of oligos by agarose electrophoresis, RAPD analysis of DNA, cDNA synthesis using PCR, Southern and Northern blotting experiments.

### **ABC 552 Techniques in Biochemistry I (Theoretical Aspects)**

**2+0**

#### **Theory**

Chromatographic and electrophoretic methods of separation, Principles and applications of Paper, Thin layer & HPTLC, Gas-liquid & Liquid chromatography, HPLC; gel electrophoresis, Different variants of polyacrylamide gel electrophoresis (PAGE) like native and SDS-PAGE, 2D-PAGE, capillary electrophoresis.

Spectrophotometry: Principles and applications UV-Visible, Fluorescence, IR, NMR and FTNMR, ESR and X-Ray spectroscopy.

Tracer techniques in biology: Concept of radioactivity, concept of  $\alpha$ ,  $\beta$  and  $\gamma$  emitters, scintillation counters,  $\gamma$ -ray spectrometers, autoradiography, applications of radioactive tracers in biology.

### **ABC 553 Plant Biochemistry I**

**3+0**

#### **Theory**

Plant cell organelles, structure and function of cell organelle. Photosynthetic pigments in relation to their functions, photosynthesis, C<sub>3</sub>, C<sub>4</sub> and CAM pathways, photorespiration.

Sucrose-starch interconversion..

Biochemistry of seed germination and development, Biochemistry of fruit ripening, phytohormones and their mode of action.

### **ABC 601 Intermediary Metabolisms**

**3+0**

#### **Theory**

The living cell: a unique chemical system, Introduction to metabolism, transport mechanism, bioenergetics, biological oxidation.

Catabolic and anabolic pathways of carbohydrates, lipids, and regulation. Energy transduction and oxidative phosphorylation.

General reactions of amino acid metabolism, Degradative and biosynthetic pathways of amino acids and their metabolic disorders.

Compartmentation of metabolic pathways, metabolic profiles of major organs and regulation of metabolic pathways.

### **ABC 602 Carbon Nitrogen and Sulphur Metabolism**

**3+1**

#### **Theory**

Carbon metabolism: Synthesis of sucrose, Regulation of sucrose phosphate synthesis, synthesis of starch in leaves and seeds, concept of transitory starch.

Synthesis of fructose, galactomannans raffinose series oligosaccharides and trehalose.

Nitrogen cycle- Biochemistry of nitrate assimilation and its regulation, GS/GOGAT and GDH pathway, ureides and amides as nitrogen transport compounds, chemoautotrophy in denitrifying bacteria.

Biological nitrogen fixation; structure function and regulation of nitrogenase; *nif* genes; biochemical basis of legume-Rhizobium symbiosis; Sulphur metabolism.

**Practical**

Estimation of protein by Lowry's method, Estimation of starch, Estimation of nitrate content by hydrazine sulphate reduction method, *in vivo* assay of nitrate reductase activity, *in vitro* assay of nitrate reductase activity, *in vitro* assay of nitrite reductase activity, *in vitro* assay of glutamine synthetase activity, *in vitro* assay of glutamate synthase and glutamate dehydrogenase activity, Estimation of ureids and amides.