Master of Science
M. Sc Biochemistry Semester I

Course Code	PS01CBIC22	Title of the Course	Intermediary Metabolism
Total Credits of the Course	04	Hours per Week	04

Course Objectives:	Students should be able to : (1) Understand reactions and importance of cellular metabolism and connection to physiology (2) understand some of the clinical pathology like starvation, Diabetes, etc.

Course Content		
Unit	Description	Weightage* (%)
1.	Important Bioenergetics concepts: Cells Require Sources of Free Energy Actual Free-Energy Changes Depend on Reactant and Product Concentrations Concept of standard free energy and its relation to free energy and equilibrium constants Calculation of standard free energy of biochemical reactions and membrane transport Standard Free-Energy Changes Are Additive The central axis of Intermediary metabolism: Glycolysis, Oxidative decarboxylation of Pyruvate, Citric acid cycle & oxidative phosphorylation & their regulation, Un-couplers and inhibitors of energy transfer. The role of TCA cycle intermediates to generate biosynthetic intermediates: Generation of Acetyl-CoA in cytosol by citrate, roles of Oxaloacetate and α- keto glutarate to generate amino acids. The central role of Acetyl-CoA in Carbohydrate, Fat and Protein metabolism.	25
2.	Regulation of blood glucose homeostasis Adaptation of Carbohydrate metabolism in starvation: Gluconeogenesis, Metabolic cooperation between Liver and muscle: Glycogenolysis, Cori's cycle, metabolism in brain, liver, adipose tissue; synthesis & utilization of ketone bodies	25

	Adaptation of Carbohydrate metabolism in hyperglycemia: Glycogenesis, Pentose phosphate pathway A brief overview of Cellular uptake of fatty acids α,β , ώ oxidation of fatty acids and lipid peroxidation. Fatty acid biosynthesis: Acetyl CoA carboxylase, Fatty acid synthase, desaturase and elongase. Lipid biosynthesis: Biosynthesis of triacylglycerol, phosphoglycerides, sphingolipids. Biosynthesis pathways for steroids and prostaglandins.	
3.	Degradation of amino acid and their regulation, oxidative deamination, Urea cycle and its regulation. Linkage between urea cycle and citric acid cycle Biosynthesis of amino acids and regulation. Biosynthesis of aminolevulinate and Biosynthesis of heme from aminolevulinate.and degradation of heme to bilirubin. Biosynthesis of creatine and phosphocreatine. Biosynthesis of purines and pyrimidines and regulation, Degradation of purines and pyrimidines, and regulation Biosynthesis, Structure and regulation of ribonucleotide reductase, biosynthesis of ribonucleotides, deoxyribonucleotides and polynucleotides	25
4.	ROS as inevitable by-products of aerobic metabolism Role of NADPH and glutathione in protecting cells against highly reactive oxygen derivatives. Glutathione metabolism Metabolic dysfunction in human diseases: hypertension, hyperlipidemia, atherosclerosis and metabolic syndrome Inborn errors of metabolism: Glycogen storage diseases, phenylketonuria, albinism, Homocystinuria, Maple-syrup urine disease, Gaucher disease, Fabry disease, Lesch-Nyhan syndrome, Gout	25

Teaching-Learning Methodology	Topics will be taught and discussed in interactive sessions using conventional black board and chalk as well as ICT tools such as power point presentations and videos. Practical sessions will be conducted in a suitably equipped laboratory either individually or in groups depending on the nature of exercise as well as availability of infrastructure. Course materials will be provided from primary and secondary sources of information.

Evaluation Pattern		
Sr. No.	Details of the Evaluation	Weightage
1.	Internal Written / Practical Examination (As per CBCS R.6.8.3)	15%
2.	Internal Continuous Assessment in the form of Practical, Viva-voce, Quizzes, Seminars, Assignments, Attendance (As per CBCS R.6.8.3)	15%
3.	University Examination	70%

Course Outcomes: Having completed this course, the learner will be able to	
1.	Student should know normal blood metabolites and should be able to relate to abnormal metabolic conditions and understand diagnosis of metabolic disorders.

Suggested References:	
Sr. No.	References
1.	Nelson David L. and Cox Michael M. (2017). Lehninger Principles of Biochemistry (7th Edn). W.H.Freeman & Co Ltd, Macmillan Publishers, United States of America.
2.	Victor Rodwell, David Bender, et al. (2018). Harper's Illustrated Biochemistry (31st Edn). McGraw-Hill Education, Ahmedabad.

3.	Jeremy Berg, John L. Tymoczko and Gregory J. Gatto Jr and Lubert Stryer (9th Ed.) (2019). Biochemistry. Macmillan Publishers, United States.
4.	Thomas M. Devlin (2010). Textbook of Biochemistry With Clinical Correlations. (7th Edn.) Wiley-Liss, Inc., New York.

On-line resources to be used if available as reference material
On-line Resources
Related review articles and research papers