COURSE TITLE	**FUNDAMENTALS OF BIOLOGY**
COURSE CODE	**01CB1101**
COURSE CREDITS	**4**

Objective:

1 This course will cover fundamental concepts of biology to help students understand and analyze the structure and function of cells, biomolecules, enzymes, nucleic acids, the cell cycle, and signal transduction pathways.

2 This course will enable students to analyze and evaluate key cellular mechanisms, including enzyme function, genetic material activity, cell cycle progression, and signaling processes in biological systems.

Course Outcomes: After completion of this course, student will be able to:

1 Apply the concepts of cell structure, biomolecules, enzymes, and nucleic acids.

2 Analyze the relationship between structure and function of cells, biomolecules, and nucleic acids in biological systems.

3 Evaluate the role and efficiency of enzymes, biomolecules, and signaling pathways in maintaining cellular functions.

4 Design solutions to predict the impact of disruptions (mutations, inhibitors, or signaling defects) on cellular function.

Pre-requisite of course: None

Teaching and Examination Scheme

Theory Hours	Tutorial Hours	Practical Hours	ESE	IA	CSE	Viva	Term Work
3	0	2	50	30	20	25	25

Contents : Unit	Topics	Contact Hours
1	**Prokaryotic and eukaryotic cell structure and function** Prokaryotic and eukaryotic cell structure. , Bio membrane, Transport across cell membranes – passive diffusion, facilitated diffusion, co- transport and active transport., Cell organelles., Cytoskeleton structure and functions., Cell communication and multicellularity: signals, signal receptors, response to signals.	9
2	**Biomolecules** Types of macro molecules, metabolites and products. , Cellular carbohydrates. , lipids and their classification. , Classification and properties of amino acids., Peptides and structure of proteins, protein folding and stability.	9

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Contents : Unit	Topics	Contact Hours
3	**Enzymes** Characterization, Properties and Classification., Enzyme structure and mechanism., Enzyme Thermodynamics and Kinetics., Factors affecting Enzyme activity., Enzyme catalysis, Enzyme Inhibition., Cofactors and coenzymes, Regulatory enzymes.	7
4	**Nucleic acids** DNA and RNAs. Types of DNA. Types of RNA (mRNA, tRNA, rRNA, miRNA and siRNA)., Nucleoside and nucleotides. , Structure, function and properties of nucleic acids., Central dogma of the cell and protein synthesis in organisms: DNA replication, transcription, translation, and post-transcriptional modifications.	8
5	**Cell cycle and signal transduction** Overview and significance of the cell cycle., Phases of the cell cycle: G1, S, G2, M phase., Mitosis: stages and significance., Meiosis: stages and biological importance., Cell cycle regulation and checkpoints (G1/S, G2/M, spindle checkpoint)., Role of cyclins and cyclin-dependent kinases (CDKs)., Apoptosis (programmed cell death) and its significance., Signal transduction pathways and cascades., Role of signal transduction in cell growth, differentiation, and apoptosis.	9
Total Hours		**42**

Suggested List of Experiments:

Contents : Unit	Topics	Contact Hours
1	**Experiment 1** Functioning of microscopes; studying the diversity of cells using permanent slides..	2
2	**Experiment 2** Experiment 2 Subjecting cells to different concentrations and analyzing the structural changes occurring due to osmosis.	2
3	**Experiment 3** Quantitative estimation of reducing sugars in samples.	2
4	**Experiment 4** Quantitative estimation of non-reducing sugars.	2
5	**Experiment 5** Quantitative estimation of proteins.	2
6	**Experiment 6** Classification of Enzymes Based on Substrate Specificity Using Amylase.	2
7	**Experiment 7** Study the effect of Temperature and pH on enzyme activity.	2
8	**Experiment 8** Study effect of cofactors on enzyme activity.	2

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Suggested List of Experiments:

Contents : Unit	Topics	Contact Hours
9	**Experiment 9** Extraction of genomic DNA from a microbe/plant/animal cell.	2
10	**Experiment 10** Agarose Gel Electrophoresis.	2
11	**Experiment 11** Quantification of DNA.	2
12	**Experiment 12** Optimization of PCR conditions for amplification of DNA.	2
13	**Experiment 13** Optimization of RT-PCR conditions for amplification of RNA.	2
14	**Experiment 14** Growing root tips of different plants and comparing the chromosome number by fixing at metaphase stage.	2
Total Hours		**28**

Textbook :

1 Molecular Cell Biology 7 th edition., Harvey Lodish, Arnold Berk, Chris A. Kaiser, Monty Krieger, Anthony Bretscher, Hidde Ploegh, Angelika Amon, Matthew P. Scott., W.H. Freeman. USA, 2012

References:

1 Harpers Illustrated Biochemistry 30th Edition., Harpers Illustrated Biochemistry 30th Edition., Victor Rodwell, David Bender, Kathleen M. Botham, Peter J. Kennelly, P. Anthony Weil., McGraw-Hill education, USA., 2015

2 The Cell: A Molecular Approach. 6th edition, The Cell: A Molecular Approach. 6th edition, Geoffrey M. Cooper and Robert E. Hausman, Sinauer Associates, Inc. USA., 2013

3 Molecular Biology of the Cell. 6th edition., Molecular Biology of the Cell. 6th edition., Bruce Alberts, Alexander Johnson, Julian Lewis, David Morgan, Martin Raff, Keith Roberts and Peter Walter., Garland Science, USA., 2014

Suggested Theory Distribution:

The suggested theory distribution as per Bloom's taxonomy is as follows. This distribution serves as guidelines for teachers and students to achieve effective teaching-learning process

Distribution of Theory for course delivery					
Remember / Knowledge	**Understand**	**Apply**	**Analyze**	**Evaluate**	**Higher order Thinking / Creative**
		35.00	35.00	30.00	

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Instructional Method:

1. The course delivery method will depend upon the requirement of content and need of students. The teacher in addition to conventional teaching method by black board, may also use any of tools such as demonstration, role play, Quiz, brainstorming, MOOCs etc.
2. The internal evaluation will be done on the basis of continuous evaluation of students in the laboratory and class-room.
3. Practical examination will be conducted at the end of semester for evaluation of performance of students in laboratory.

Supplementary Resources:

1. https://visualgo.net/en
2. https://www.cs.usfca.edu/~galles/visualization/Algorithms.html
3. https://quizlet.com

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