Shri Vaishnav Vidyapeeth Vishwavidyalaya, Indore

Shri Vaishnav Institute of Science
Department of Life Science
B.Sc. (Major - Biotechnology)

SEMESTER II

COURSE CODE	Category	COURSE NAME	TEACHING & EVALUATION SCHEME								
			THEORY			PRACTICAL		Th	T	P	CREDITS
			END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*				
BSCBT201	**Major**	**Cell Biology and Cell Signaling**	60	20	20	30	20	4	-	4	6

Legends: **L** - Lecture; **T** - Tutorial/Teacher Guided Student Activity; **P** – Practical; **C** - Credit;
***Teacher Assessment shall be based following components: Quiz / Assignment / Project / Participation in Class, given that no component shall exceed more than 10 marks.**

Course Objectives:
The objectives of this course are to sensitize the students to the fact that as we go down the scale of magnitude from cells to organelles to molecules, the understanding of various biological processes becomes deeper and inclusive.

Course Outcomes: Students will
(1) Understand the structures and purposes of basic components of prokaryotic and eukaryotic cells, especially macromolecules, membranes, and organelles.
(2) Apply their knowledge of cell biology to selected examples of changes or losses in cell function.

UNIT-I:
Cell theory, Structure of prokaryotic and eukaryotic cells. Structure and function of – Mitochondria and Chloroplast, Nucleus and Nucleolus, Endoplasmic reticulum, Golgi apparatus, Lysosomes, Ribosomes. Structure and function of Cell membrane and Cell wall.

UNIT–II:
Transport across membranes – active transport, ABC transporters, Ion channels. Intra-cellular transport (vesicular and membrane transport). Vesicular Traffic in the Secretary and Endocytic Pathway, Transport from ER through the Golgi apparatus, Transport from the Trans Golgi network.

UNIT–III:
Cellular Processes – Cell cycle and its regulation, Role of Cyclins, CDKs in cell cycle. Apoptosis – Programmed cell death. Cancer Biology Mutations, proto-oncogenes, oncogenes and tumor suppressor genes. Carcinogens and their types: physical, chemical and biological. Mutagens and their types.

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BSCBT201 Cell Biology and Cell Signaling

UNIT–IV:

Cell Communication – Overview of extracellular signaling, Cell surface receptors in signal transduction: G-protein coupled receptor, Tyrosine kinase linked receptors, Receptors with intrinsic enzyme activity (RTK). Interaction and regulation of cell signaling pathways.

UNIT–V:

Tools and techniques of Cell Biology – Principles of Light microscopy; Phase contrast microscopy; Confocal microscopy, Spectrophotometry, Separation-Sub-cellular fractionation-differential and density gradient centrifugation; Chromatography- paper, thin-layer, gel-filtration.

PRACTICAL

1. Microscopy- Theoretical knowledge of Light and Electron microscope.
2. Observation of various stages of mitosis and meiosis.
3. Identification of the cell membrane, nucleus and cytoplasm in an animal cell and the cell wall, cell membrane, nucleus and chloroplasts in a plant cell.
4. Methods of cell lysis: osmotic/enzymatic/chemical.
5. Permanent slides of: Prokaryote, Eukaryote, Muscle, Nerve, Stomata

BOOKS

1. Alberts, B., Johnson, A., Lewis, J., Raff, M., Roberts, K., & Walter, P. (2014). Molecular Biology of the Cell (6th Ed.). New York: Garland Science.
2. Lodish, H. F. (2021). Molecular Cell Biology (9th Ed.). New York: W.H. Freeman.
3. Cooper, G. M., & Hausman, R. E. (2013). The Cell: a Molecular Approach (6th Ed.). Washington: ASM ; Sunderland.
4. Cell Biology, 7th edition, (2014) Gerald Karp. John Wiley & Sons., USA

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BSCCH201	**Minor**	**Physical Chemistry I**	60	20	20	30	20	4	-	4	6

Legends: **L** - Lecture; **T** - Tutorial/Teacher Guided Student Activity; **P** – Practical; **C** - Credit;
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Course Educational Objectives (CEOs):
The subject aims to provide the student with:
1. To develop basic concepts regarding three states of matters.
2. To acquire required knowledge about concept of electromotive force and its applications.
3. To study the concept of ionization in aqueous solution, pH, Buffer, and application of ionization.
4. To understand phase, co-existence of Phases, Phase diagram.
5. To acquaint the students with practical knowledge of the concepts of Physical chemistry.

Course Outcomes: -
After completion of this course the students are expected to be able to demonstrate following knowledge, skills, and attitudes. The student will demonstrate capability of

CO1. Derive mathematical expressions for different properties of gas, liquid, solids and understand their physical significance.
CO2. Became aware of the importance of Electrochemistry and its applications.
CO3. Explain the concept of ionization of electrolytes with emphasis on weak acid and base and hydrolysis of salt. Understand and explain the types of Phases, components, Gibb's phase Rule, Phase diagrams and applications.
CO4. Demonstrate a fundamental/systematic understanding of the practical field of Chemistry

SYLLABUS:

UNIT I

Gaseous state:

Gas Laws, Kinetic molecular model of a gas: postulates and derivation of the kinetic gas equation. Ideal and real gas, Deviations from ideal gas behavior, Causes of deviation from ideal behavior. Vander Waal's equation of state. Maxwell distribution and its use in evaluating molecular velocities (average, root mean square and most probable) and average kinetic energy. Collision frequency; Collision diameter; Mean free path.

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BSCCH201 Physical Chemistry I

UNIT II
Liquid state:
Introduction, Qualitative treatment of the structure of the liquid state; Physical properties of liquids; vapor pressure, surface tension and coefficient of viscosity, and their determination. Effect of addition of various solutes on surface tension and viscosity.

Solid state:
Nature of the solid state, law of constancy of inter facial angles, law of rational indices, Miller indices, elementary ideas of symmetry, symmetry elements and symmetry operations, qualitative idea of point and space groups, seven crystal systems and fourteen Bravaislattices; X-ray diffraction, Bragg's law, a simple account of rotating crystal method and powder pattern method.

UNIT III
Electrochemistry
Quantitative aspects of Faraday's laws of electrolysis, rules of oxidation/reduction of ions based on half-cell potentials, applications of electrolysis in metallurgy and industry. Chemical cells, reversible and irreversible cells with examples. Electromotive force of a cell and its measurement, Nernst equation; Standard electrode (reduction) potential and its application to different kinds of half-cells. Qualitative discussion of potentiometric titrations (acid-base, redox, precipitation).

UNIT IV
Ionic equilibria:
Strong, moderate, and weak electrolytes, degree of ionization, factors affecting degree of ionization, ionization constant and ionic product of water. Ionization of weak acids and bases, pH scale, common ion effect; dissociation constants of mono-, di- and tri-protic acids (exact treatment). Salthydrolysis-calculation of hydrolysis constant, degree of hydrolysis and pH for different salts.

Buffer solutions; derivation of Henderson equation and its applications; buffer capacity, buffer range, buffer action and applications of buffers in analytical chemistry and biochemical processes in the human body. Solubility and solubility product of sparingly soluble salts – applications of solubility product principle.

UNIT V
Phase equilibria:
Definitions of phase, component, and degrees of freedom. Phase rule and its derivations. Definition of phase diagram. Phase equilibria for one component system – water, CO2. First order phase transition and Clapeyron equation; Clausius-Clapeyron equation - derivation and use. Solid-liquid phase diagram. Eutecticmixture.

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BSCCH201 Physical Chemistry I

List of Practical:
Practical: (Credits: 2, Laboratory periods: 04)

Surface tension measurements using Stalagmometer.
1. Determine the surface tension of aqueous solutions by (i) drop number (ii) drop weight method.
2. Study the variation of surface tension with different concentration of detergent solutions. Determine CMC.

Viscosity measurement using Ostwald's viscometer.
3 Determination of co-efficient of viscosity of an unknown aqueous solution.
4 Estimation of iron by potentiometry.
5 To purify a given sample of phthalic acid by sublimation.
6. Conductometric titration -determination of strength of an acid.
7. To verify Lambert-Beer's law for K2Cr2 O7 by Colorimetrically.

pH-metry:
8. Determination of the strength of a given hydrochloric acid solution against a standard sodium hydroxide solution. (pH metric titration)
9. Preparation of buffer solutions of different pH values (a) Sodium acetate-acetic acid (b) Ammonium chloride-ammonium hydroxide
10. Study of Phase diagram of Phenol-Water system

Reference Books:

1. Atkins, P.W.& Paula,J.de Atkin's Physical Chemistry 8th Ed., Oxford University Press (2006).
2. Ball, D. W. Physical Chemistry Thomson Press, India (2007).
3. Castellan,G. W. Physical Chemistry 4th Ed. Narosa (2004).
4. Mortimer, R.G. Physical Chemistry 3rd Ed. Elsevier: NOIDA,UP(2009).

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