MOHANLAL SUKHADIA UNIVERSITY, UDAIPUR

B. Sc. BIOTECHNOLOGY SEMESTER –IV (2016-17)

Paper I: *Core Course 10 (B4CT10BOT04) Botany -IV*
Plant Physiology and Metabolism (Theory)
(Credits: Theory-4, Practicals-2)
Credit hours: 60

Unit 1: Plant-water relations **10 Credit hours**

Importance of water, water potential and its components; Transpiration and its significance; Factors affecting transpiration; Root pressure and guttation.

Unit 2: Mineral nutrition **10 Credit hours**

Essential elements, macro and micronutrients; Criteria of essentiality of elements; Role of essential elements; Transport of ions across cell membrane, active and passive transport, carriers, channels and pumps.

Unit 3: Photosynthesis and Respiration **15 Credit hours**

Photosynthetic Pigments (Chl a, b, xanthophylls, carotene); Photosystem I and II, reaction center, antenna molecules; Electron transport and mechanism of ATP synthesis; C3, C4 and CAM pathways of carbon fixation; Photorespiration. Glycolysis, anaerobic respiration, TCA cycle; Oxidative phosphorylation, Glyoxylate, Oxidative Pentose Phosphate Pathway.

Unit 4: Enzymes and Nitrogen metabolism **10 Credit hours**

Structure and properties; Mechanism of enzyme catalysis and enzyme inhibition. Biological nitrogen fixation; Nitrate and ammonia assimilation.

Unit 5: Plant growth regulators and Plant response **15 Credit hours**

Discovery and physiological roles of auxins, gibberellins, cytokinins, ABA, ethylene.Photoperiodism (SDP, LDP, Day neutral plants); Phytochrome (discovery and structure), red and far red light responses on photomorphogenesis; Vernalization.

Suggested Readings

1. Taiz, L., Zeiger, E., (2010). Plant Physiology. Sinauer Associates Inc., U.S.A. 5th Edition.
2. Hopkins, W.G., Huner, N.P., (2009). Introduction to Plant Physiology. John Wiley & Sons, U.S.A. 4th Edition.
3. Bajracharya, D., (1999). Experiments in Plant Physiology- A Laboratory Manual. Narosa Publishing House, New Delhi.

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B. Sc. BIOTECHNOLOGY SEMESTER –IV (2016-17)

Paper II: *Core Course 11 (B4CT11BT04): Biotechnology IV Recombinant DNA Technology (Theory)*

(Credits: Theory-4, Practicals-2)

Credit hours: 60

Unit-I **12 Credit hours**

Genetic Engineering : definition, scope and importance, molecular tools for genetic engineering. Restriction endonucleases- types, nomenclature, recognition sequences, cleavage pattern. Vectors – general characteristics of vectors, desirable characters such as size, ori site, selection/ markers gene, restriction sites and MCS, cloning and expression vectors.

Unit-II **12 Credit hours**

Plasmid vectors: pBR-322, pUC vectors, Ti-plasmid,. M13 derived pUC vectors, bacteriophage λ vectors, cosmids, YAC and BAC. Creation of recombinant DNA: cloning and selection of individual gene.

Transformation techniques: preparation of competent cells of bacteria, physical and chemical methods of gene tranfer in plant and animal cells.

Unit-III **12 Credit hours**

Genomic library and cDNA library, reverse transcriptase, Colony hybridization, screening by DNA hybridization, labelling of DNA, RNA and proteins: use of radioactive isotopes, non-radioactive labelling, relative advantages, *in vivo* labelling, nick translation, random primer labelling, autoradiography. Blotting techniques southern,northern, western and eastern.

Unit-IV **12 Credit hours**

Protein profiling: SDS PAGE, 2D gel electrophoresis and its significance, gel retardation assay, T-DNA and transposon mediated gene tagging, chloroplast transformation and its utility, DNA microarray.

Unit-V **12 Credit hours**

Antisense RNA technology, Ribozyme: biochemistry, hammerhead, hair pin and other ribozymes, strategies for designing ribozymes, application of antisense and ribozyme technologies.

Suggested Readings

1. Christopher, H. Gene cloning and Manipulation. Cambridge University, Press.
2. Nicholl, D.S.T. An introduction to genetic engineering. Cambridge University Press.
3. Sambrook, Russell and Maniatis. Molecular Cloning : A Laboratory Manual (Vol. I, II and III). Cold Spring Harber Laboratory.
4. Glover, D.M. and Hames, B.D. DNA Cloning : A practical approach. IRL Press. Oxford.
5. Brown, T.A. Gene cloning. Blackwell Publisher.
6. Kreuzar, H. and Massey, A. Recombinant DNA technology. A.S.M. Press, Washington.
7. Llibelli, Lanza and Campbell. Principles of Cloning. Academic Press.

MOHANLAL SUKHADIA UNIVERSITY, UDAIPUR

B. Sc. BIOTECHNOLOGY SEMESTER –IV (2016-17)

Paper III: *Core Course 12 (B4CT12CHE04): Chemistry IV Chemistry of S- and P-Block Elements, States Of Matter & Chemical Kinetics (Theory)*

(Credits: Theory-4, Practicals-2)

Credit hours: 60

UNIT I **15 Credit hours**

General Principles of Metallurgy

Chief modes of occurrence of metals based on standard electrode potentials. Ellingham diagrams for reduction of metal oxides using carbon as reducing agent.
Hydrometallurgy, Methods of purification of metals (Al, Pb, Ti, Fe, Cu, Ni, Zn): electrolytic, oxidative refining, Kroll process, Parting process, van Arkel-de Boer process and Mond's process.

***s*- and *p*-Block Elements**

Periodicity in *s*- and *p*-block elements with respect to electronic configuration, atomic and ionic size, ionization enthalpy, electronegativity (Pauling, Mulliken, and Alfred-Rochow scales). Allotropy in C, S, and P.

Oxidation states with reference to elements in unusual and rare oxidation states like carbides and nitrides), inert pair effect, diagonal relationship and anomalous behaviour of first member of each group.

UNIT II **10 Credit hours**

Compounds of *s*- and *p*-Block Elements

Hydrides and their classification (ionic, covalent and interstitial), structure and properties with respect to stability of hydrides of p- block elements.
Concept of multicentre bonding (diborane).
Structure, bonding and their important properties like oxidation/reduction, acidic/basic nature of the following compounds and their applications in industrial, organic and environmental chemistry.
Hydrides of nitrogen (NH_3, N_2H_4, N_3H, NH_2OH)
Oxoacids of P, S and Cl.
Halides and oxohalides: PCl_3, PCl_5, $SOCl_2$ and SO_2Cl_2

UNIT III

15 Credit hours

Kinetic Theory of Gases

Postulates of Kinetic Theory of Gases and derivation of the kinetic gas equation.

Deviation of real gases from ideal behaviour, compressibility factor, causes of deviation. van der Waals equation of state for real gases. Boyle temperature (derivation not required). Critical phenomena, critical constants and their calculation from van der Waals equation. Andrews isotherms of CO_2.

Maxwell Boltzmann distribution laws of molecular velocities and molecular energies (graphic representation – derivation not required) and their importance.

Temperature dependence of these distributions. Most probable, average and root mean square velocities (no derivation). Collision cross section, collision number, collision frequency, collision diameter and mean free path of molecules. Viscosity of gases and effect of temperature and pressure on coefficient of viscosity (qualitative treatment only).

UNIT IV **10 Credit hours**

Liquids

Surface tension and its determination using stalagmometer. Viscosity of a liquid and determination of coefficient of viscosity using Ostwald viscometer. Effect of temperature on surface tension and coefficient of viscosity of a liquid (qualitative treatment only)

Solids

Forms of solids. Symmetry elements, unit cells, crystal systems, Bravais lattice types and identification of lattice planes. Laws of Crystallography - Law of constancy of interfacial angles, Law of rational indices. Miller indices. X–Ray diffraction by crystals, Bragg's law. Structures of NaCl, KCl and CsCl (qualitative treatment only). Defects in crystals. Glasses and liquid crystals.

UNIT V

10 Credit hours

Chemical Kinetics

The concept of reaction rates. Effect of temperature, pressure, catalyst and other factors on reaction rates. Order and molecularity of a reaction. Derivation of integrated rate equations for zero, first and second order reactions (both for equal and unequal concentrations of reactants). Half–life of a reaction. General methods for determination of order of a reaction. Concept of activation energy and its calculation from Arrhenius equation.

Theories of Reaction Rates: Collision theory and Activated Complex theory of bimolecular

reactions. Comparison of the two theories (qualitative treatment only).

Reference Books:

1. G. M. Barrow: *Physical Chemistry* Tata McGraw Hill (2007).
2. G. W. Castellan: *Physical Chemistry* 4th Edn. Narosa (2004).
3. J. C. Kotz, P. M. Treichel & J. R. Townsend: *General Chemistry* Cengage Lening India Pvt. Ltd., New Delhi (2009).
4. B. H. Mahan: *University Chemistry* 3rd Ed. Narosa (1998).
5. R. H. Petrucci: *General Chemistry* 5th Ed. Macmillan Publishing Co.: New York (1985).
6. J. D. Lee: *A New Concise Inorganic Chemistry*, E.L.B.S.
7. F.A. Cotton & G. Wilkinson: *Basic Inorganic Chemistry*, John Wiley.
8. D. F. Shriver and P. W. Atkins: *Inorganic Chemistry*, Oxford University Press.
9. Gary Wulfsberg: *Inorganic Chemistry*, Viva Books Pvt. Ltd.

MOHANLAL SUKHADIA UNIVERSITY, UDAIPUR

B. Sc. BIOTECHNOLOGY SEMESTER –V & VI (2016-17)

Discipline Specific Elective Courses
Two (2) be selected from each of the three disciplines

Discipline Specific Elective Botany

1. Cell and Molecular Biology

(Credits: Theory-4, Practicals-2)

THEORY

Credit hours: 60

Unit 1: Techniques in Biology **10 Credit hours**

Principles of microscopy; Light Microscopy; Phase contrast microscopy; Fluorescence microscopy; Confocal microscopy; Sample Preparation for light microscopy; Electron microscopy (EM)- Scanning EM and Scanning Transmission EM (STEM); Sample Preparation for electron microscopy; X-ray diffraction analysis.