MOHANLAL SUKHADIA UNIVERSITY, UDAIPUR

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

Paper I: *Core Course 7 (B3CT07BOT03) Botany-III*
Plant Anatomy and Embryology (Theory)
(Credits: Theory-4, Practicals-2)
Credit hours: 60

Unit 1: Meristematic and permanent tissues **10 Credit hours**

Root and shoot apical meristems; Simple and complex tissues. Structure of dicot and monocot root stem and leaf.

Unit 2: Secondary Growth **15 Credit hours**

Vascular cambium – structure and function, seasonal activity. Secondary growth in root and stem, Wood (heartwood and sapwood). Adaptive and protective systems- Epidermis, cuticle, stomata; General account of adaptations in xerophytes and hydrophytes.

Unit 3: Structural organization of flower **15 Credit hours**

Structure of anther and pollen; Structure and types of ovules; Types of embryo sacs, organization and ultrastructure of mature embryo sac.

Unit 4: Pollination and fertilization **10 Credit hours**

Pollination mechanisms and adaptations; Double fertilization; Seed-structure appendages and dispersal mechanisms.

Unit 5: Embryo and endosperm **10 Credit hours**

Endosperm types, structure and functions; Dicot and monocot embryo; Embryo endosperm relationship. Apomixis and polyembryony

Suggested Readings

1. Bhojwani, S.S. & Bhatnagar, S.P. (2011). Embryology of Angiosperms. Vikas Publication House Pvt. Ltd. New Delhi. 5th edition.
2. Mauseth, J.D. (1988). Plant Anatomy. The Benjamin/Cummings Publisher, USA.

MOHANLAL SUKHADIA UNIVERSITY, UDAIPUR

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

Paper II: *Core Course 8 (B3CT08BT03): Biotechnology III*

Plant Biotechnology (Theory)

(Credits: Theory-4, Practicals-2)

Credit hours: 60

Unit-I **15 Credit hours**

Plant tissue culture- History, contribution of Indian Scientists. Concept of cellular totipotancy and differentiation, laboratory facilities and supplies, asepsis and methods of sterilization. Culture medium- composition and methods of preparation. Role of plant growth regulators, vitamins and other adjuvants.

Unit-II **15 Credit hours**

Pathways of micropropagation- axillary bud proliferation, adventitious shoot bud proliferation, Callus organogenesis, Somatic embryogenesis, Steps of micropropagation-management of donor plants, culture establishment, shoot multiplication, rooting, hardening and acclimatization.

Unit-III **10 Credit hours**

Protoplast isolation, culture and Somatic hybridization, production of haploids -Anther and pollen culture, ovary culture. Embryo and endosperm culture. Embryo rescue. Production of synthetic seeds.

Unit-IV **10 Credit hours**

.*In vitro* fertilization, Methods of cryopreservation for germplasm conservation. Somaclonal and gametoclonal variation. Meristem tip culture for elimination of viruses in plants. Commercialization of plant tissue culture- Global scenario and plant tissue culture industries in India.

Unit-V **10 Credit hours**

Cell culture and *in vitro* production of secondary metabolites. Important alkaloids and factors affecting their production. Hairy root culture, elicitation and biotransformation, Bioreactors – their types, construction and use in secondary metabolite production.

Suggested Readings

1. Robert Smith. Plant tissue culture : Techniques and Experiments. South Asia Edition.
2. Gamborg and Phillip. Plant Cell, Tissue and Organ Culture. Narosa.
3. Dixon and Gonzales. Plant Cell Culture. Panima.
4. Narayanswamy. Plant Cell and Tissue Culture. McGraw Hill.
5. Bhojwani, S.S. and Rajdan, M.K. Plant Tissue Culture : Theory and Practices a revised Edition. Elsevier.
6. Razdan, M.K. Introduction to plant tissue culture. Oxford & IBH Publishers.
7. Chawla, H.S. Introduction to Plant Biotechnology. Oxford & IBH Publishers.
8. Dey, K.K. Plant Tissue Culture.
9. Purohit, S.D. Introduction to Plant Cell Tissue and organ culture.

MOHANLAL SUKHADIA UNIVERSITY, UDAIPUR

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

Paper III: *Core Course 9 (B3CT09CHE03): Chemistry III*

Solutions, Phase Equilibrium, Conductance, Electrochemistry & Functional Group Organic Chemistry-II (Theory)

(Credits: Theory-4, Practicals-2)
Credit hours: 60

UNIT I **10 Credit hours**

Solutions

Thermodynamics of ideal solutions: Ideal solutions and Raoult's law, deviations from Raoult's law – non-ideal solutions. Vapour pressure-composition and temperature-composition curves of ideal and non-ideal solutions. Distillation of solutions. Lever rule. Azeotropes.

Partial miscibility of liquids: Critical solution temperature; effect of impurity on partial miscibility of liquids. Immiscibility of liquids- Principle of steam distillation. Nernst distribution law and its applications, solvent extraction.

Phase Equilibrium

Phases, components and degrees of freedom of a system, criteria of phase equilibrium. Gibbs Phase Rule and its thermodynamic derivation. Derivation of Clausius – Clapeyron equation and its importance in phase equilibria. Phase diagrams of one-component systems (water and sulphur) and two component systems involving eutectics, congruent and incongruent melting points (lead-silver, $FeCl_3$-H2O and Na-K only).

UNIT II **10 Credit hours**

Conductance

Conductivity, equivalent and molar conductivity and their variation with dilution for weak and strong electrolytes. Kohlrausch law of independent migration of ions.

Transference number and its experimental determination using Hittorf and Moving

boundary methods. Ionic mobility. Applications of conductance measurements: determination of degree of ionization of weak electrolyte, solubility and solubility products of sparingly soluble salts, ionic product of water, hydrolysis constant of a salt. Conductometric titrations (only acid-base).

UNIT III **10 Credit hours**

Electrochemistry

Reversible and irreversible cells. Concept of EMF of a cell. Measurement of EMF of a cell. Nernst equation and its importance. Types of electrodes. Standard electrode potential. Electrochemical series. Thermodynamics of a reversible cell, calculation of thermodynamic properties: *G*, *H* and *S* from EMF data.

Calculation of equilibrium constant from EMF data. Concentration cells with transference and without transference. Liquid junction potential and salt bridge. pH determination using hydrogen electrode and quinhydrone electrode.

Potentiometric titrations -qualitative treatment (acid-base and oxidation-reduction only).

UNIT IV **10 Credit hours**

Functional group approach for the following reactions (preparations & reactions) to be studied in context to their structure.

Carboxylic acids and their derivatives

Carboxylic acids (aliphatic and aromatic)

Preparation: Acidic and Alkaline hydrolysis of esters.

Reactions: Hell – Vohlard - Zelinsky Reaction.

Carboxylic acid derivatives (aliphatic): (Upto 5 carbons)

Preparation: Acid chlorides, Anhydrides, Esters and Amides from acids and their interconversion.

Reactions: Comparative study of nucleophilicity of acyl derivatives. Reformatsky Reaction, Perkin condensation.

UNIT V **20 Credit hours**

Amines and Diazonium Salts

Amines (Aliphatic and Aromatic): (Upto 5 carbons)

Preparation: from alkyl halides, Gabriel's Phthalimide synthesis, Hofmann Bromamide reaction.

Reactions: Hofmann vs. Saytzeff elimination, Carbylamine test, Hinsberg test, with HNO_2, Schotten – Baumann Reaction. Electrophilic substitution (case aniline): nitration, bromination, sulphonation.

Diazonium salts: *Preparation:* from aromatic amines.

Reactions: conversion to benzene, phenol, dyes.

Amino Acids, Peptides and Proteins:

Preparation of Amino Acids: Strecker synthesis using Gabriel's phthalimide synthesis. Zwitterion, Isoelectric point and Electrophoresis.

Reactions of Amino acids: ester of –COOH group, acetylation of $–NH_2$ group, complexation with Cu^{2+} ions, ninhydrin test.

Overview of Primary, Secondary, Tertiary and Quaternary Structure of proteins.

Determination of Primary structure of Peptides by degradation Edmann degradation (N-terminal) and C–terminal (thiohydantoin and with carboxypeptidase enzyme). Synthesis of simple peptides (upto dipeptides) by N-protection (t-butyloxycarbonyl and phthaloyl) & C-activating groups and Merrifield solid-phase synthesis.

Carbohydrates: Classification, and General Properties, Glucose and Fructose (open chain and cyclic structure), Determination of configuration of monosaccharides, absolute configuration of Glucose and Fructose, Mutarotation, ascending and descending in monosaccharides. Structure of disacharrides (sucrose, cellobiose, maltose, lactose) and polysacharrides (starch and cellulose) excluding their structure elucidation.

Reference Books:

1. G. M. Barrow: *Physical Chemistry* Tata McGraw Hill (2007).

2. G. W. Castellan: *Physical Chemistry* 4th Ed. Narosa (2004).
3. J. C. Kotz, P. M. Treichel, J. R. Townsend, *General Chemistry*, Cengage Learning India Pvt. Ltd.: New Delhi (2009).

4. B. H. Mahan: *University Chemistry*, 3rd Edn. Narosa (1998).
5. R. H. Petrucci, *General Chemistry*, 5th Edn., Macmillan Publishing Co.: New York (1985).
6. Morrison, R. T. & Boyd, R. N. *Organic Chemistry*, Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).

7. Finar, I. L. *Organic Chemistry* (*Volume 1*), Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
8. Finar, I. L. *Organic Chemistry* (*Volume 2)*, Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
9. Nelson, D. L. & Cox, M. M. *Lehninger's Principles of Bioch*emistry *7th Ed.,* W. H. Freeman.
10. Berg, J. M., Tymoczko, J. L. & Stryer, L. *Biochemistry 7th Ed.,* W. H. Freeman