

**JYOTI NIVAS COLLEGE AUTONOMOUS
SYLLABUS FOR 2018 BATCH AND THEREAFTER**

Programme: B.Sc.

Semester: V

**BIOCHEMISTRY PAPER VI
PLANT BIOCHEMISTRY**

Course Code: 18VBC6

No. of Hours: 45

COURSE OBJECTIVES:

Through this course, the student is imparted knowledge of:

- The different types of natural products occurring in plants and their importance
- The important bio-geochemical cycles in the growth and evolution of plants
- The process of plant growth and the role of various plant hormones and nutrients.

LEARNING OUTCOMES:

By the end of the course students should be able to:

- Differentiate primary and secondary metabolites.
- Understand phytochemicals, its classification, structures and its biomedical importance.
- Understand the main biosynthetic pathways of natural products.
- Describe the importance of nitrogen in plants, types of nitrogen fixation, special mode of nutrition in plants, biochemistry of nitrogenase enzyme.
- Explain the conversion of light energy into chemical energy in photosynthesis, photosynthetic pigments.
- Familiar with different mechanisms of carbon fixation in plants.
- Able to discuss the role of hormones and nutrients in plants growth.

UNIT I

PHOTOSYNTHESIS

08 HRS

Introduction, Photosynthetic pigments: Chlorophyll a and b, carotenoids, phycobilins, anthocyanins. Soret band. Mechanism of photosynthesis: Light phase – Hill reaction, Emerson effect. Photosystems I and II, organization of photosystems. Photosynthetic apparatus and mechanism of light phase. Photophosphorylation – Cyclic and non-cyclic. Dark phase: Calvin-Benson Cycle (C3 pathway) and its regulation, Photorespiration. Hatch-Slack pathway (C4 pathway)-RUBISCO. Differences between C3 and C4 plants, Significance of C4 pathway.

UNIT II

NITROGEN FIXATION

08 HRS

Nitrogen cycle. Significance of nitrogen. Nitrogen in soil, nitrate reduction in plants, Denitrification, nitrification and ammonification. Nitrogen fixation: Biological nitrogen fixation; diazotrophs (free living bacteria), symbiotic, associative symbiotic. Symbiotic Nitrogen fixation in leguminous plants – formation of root nodules. Factors affecting nodule formation. Biochemistry of nitrogen fixation: requirements, nitrogenase complex. Reactions of symbiotic nitrogen fixation. Symbiotic synthesis of leghemoglobin. Non-biological nitrogen fixation. Sources of nitrogen in insectivorous plants – Pitcher plant, Bladderwort, Sundew, Butterwort and Venus flytrap

UNIT III

NATURAL PRODUCTS

Chapter 3.1 PHYTOCHEMICALS

02 HRS

Definition, Primary and Secondary metabolites – definition with examples. Conditions favoring secondary metabolites in plants. Classification and role of secondary metabolites, commercial importance of secondary metabolites.

Chapter 3.2 ALKALOIDS

04 HRS

Introduction, definition, general characteristics, naming. General chemical structures. General methods of extraction, Classification with examples. Structure, sources and medicinal uses of nicotine, atropine, quinine and morphine (morphine structure not required). Sources, types and uses of vinca alkaloids.

Chapter 3.3 POLYPHENOLS

06 HRS

Polyphenols: Definition occurrence and biological importance. General method of extraction. Phenyl propanoid pathway (outline). Flavonoids- Molecular structure of flavone back bone. Biological importance, structure and occurrence of the following: quercetin, epicatechin, oligomeric proanthocyanidins. List of the flavonoids present in citrus fruits, ginkgo tree, tea leaves, wine and dark chocolate. Curcuminoids- structure, sources and biological roles of curcumin.

Chapter 3.4 TERPENES

05 HRS

Introduction, Definition, Isoprene rule. General method of extraction. Biosynthesis of isoprene from mevalonate pathway (outline). Classification with examples. Biological importance, structure and occurrence of the following: limonene, menthol, santonin, juvenile hormone I, phytol, lycopene, beta carotene and plastoquinone.

UNIT IV

PLANT HORMONES

05 HRS

Introduction, phytohormones, discovery, nomenclature. Structure, functions and biosynthesis of: Auxins (tryptamine pathway) and ethylene from methionine. Structures and functions of gibberellins, cytokinins, abscisic acid. Brassinosteroids and Bataxins. Influence of plant growth regulators on *in vitro* plant regeneration.

UNIT V

PLANT NUTRIENTS

03 HRS

Definition, classification, occurrence, functions and deficiency symptoms of macronutrients (Nitrogen, Potassium, Calcium, Magnesium, Phosphorus and Sulphur) and micronutrients (Chlorine, Iron, Boron, Manganese, Sodium, Zinc, Copper, Nickel, Molybdenum, Cobalt).

UNIT VI

DORMANCY AND SENESCENCE IN PLANTS

04 HRS

Dormancy : Introduction, factors responsible for dormancy, mechanism of dormancy, methods of breaking the dormancy of seeds. Senescence: Introduction, types of senescence – organ and whole plant senescence, biological significance and mechanism of senescence.

REFERENCES:

1. Gurdeep Chatwal –Organic chemistry of Natural Products, 2nd edition-Himalaya Publishing House.
2. Hans -Walter Heldt-Plant Biochemistry, 3rd edition, Elsevier Publishers.
3. P.M. Dey and J.B. Harborne-Plant Biochemistry-Harwar-Asia, Academic Press.
4. R.C. Dubey-A Text Book of Biotechnology -S Chand and Co.
5. Mohit Verma, A Text Book of Plant Physiology and Biochemistry, 3rd edition 2000, S Chand & Co.
6. V. Verma, Text book of plant physiology, 2007, Ane Books India.

BIOCHEMISTRY
V SEMESTER PRACTICAL PAPER VI

DURATION: 3 HRS / WEEK

NO. OF UNITS: 15

1. Detection of inorganic elements in plant ash
2. Quantification of calcium from plant ash by Oxalate method.
3. Quantification of magnesium from plant ash by EDTA method.
4. Estimation of Iron in curry leaves using ammonium thiocyanate method.
5. Determination of sucrose activity.
6. Determination of starch content in potato by Benedict's method.
7. Estimation of polyphenols in a plant sample
8. Extraction of caffeine from tea leaves.
9. Extraction of limonene from citrus rinds.
10. Estimation of flavonoids in a plant sample.
11. Qualitative analysis of phytochemicals.

Repetition and Tests.

REFERENCES:

1. J. Jayaraman – Manual in Biochemistry, 2011, Second Edition, New Age International Publishers, New Delhi
2. S. Sadasivam and A. Manickam, Biochemical Methods, 2018, Third Edition, New Age Publishers, New Delhi