Bot-321 & Bot-322L PLANT BIOCHEMISTRY Credit Hours 3(2+1)
(BIOENERGETICS AND METABOLISM)

THEORY

Introduction of the Course:

This course is focused on Bioenergetics and Metabolism with a focus on energy relationships between catabolic and anabolic processes. How do the catabolic pathways deliver chemical energy? How are energy carrier molecules used in anabolic pathways? These are some of the questions that are answered making use of our knowledge of fatty acid catabolism, biosynthesis of nucleotides etc. An introduction to Alkaloids, Terpenoids and Vitamins is also presented with a focus on their general properties or role in metabolism.

Course Objectives:

The course is designed:

1. To provide an adequate knowledge of the underlying principles of Bioenergetics and Metabolism.
2. To investigate metabolism keeping in view various molecules and macromolecules like, Carbohydrates, Lipids, DNA/RNA, Proteins etc.
3. To understand the general properties and role of Alkaloids, Terpenoids and Vitamins in metabolism.

Course Detail:

Bioenergetics

a. Energy, laws about energy changes.
b. Oxidation and Reduction in living systems.

Metabolism

a. Biosynthesis, degradation and regulation of sucrose and starch. Breakdown of fats with special reference to beta-oxidation and its energy balance. Biosynthesis of fats/ fatty acids.
b. DNA replication and repair. Reverse transcription. Biosynthesis of DNA and RNA.
c. Components of protein synthesis. Genetic code. Protein synthesis: Initiation, elongation and termination.

Alkaloids

a. Occurrence, physiological effects, chemical nature with special reference to Solanine, Nicotine, Morphine, Theine and Caffeine.
b. Aflatoxins, their nature and role.

Terpenoids:

Classification: Monoterpenes, Sesquiterpenes, Diterpenes, Triterpenes, Tetraterpenes, Polyterpenes, their chemical constitution and biosynthesis.

Vitamins: General properties and role in metabolism.

Practicals:

1. Separation of soluble proteins by Polyacrylamide Gel Electrophoresis (PAGE)
2. Separation of Nucleic acids by gel electrophoresis.
3. Estimation of vitamin C (orange, apple juice).
4. Determination of potential Alkaloids in plants.
5. Estimation of Terpenoids in plants.

Teaching-learning Strategies

1. Lectures
2. Group Discussion
3. Lab work
4. Seminars/ Workshop
5. Assignments

Learning Outcome:

1. Students are expected to get themselves familiarized with the basic concepts of Bioenergetics and Metabolism.
2. They should be able to figure out the use of various biochemical reactions and to assess as to where do these individual chemical reactions fit in an overall metabolic process.
3. The students are expected to critically analyze the various biochemical pathways and their interaction with each other.
4. Students should be able to highlight the significance of Alkaloids, Terpenoids and Vitamins and the role they might play in a living system.

Assessment Strategies:

1. Lecture Based Examination (Objective and Subjective)
2. Assignments
3. Classroom discussion
4. Quizzes and Tests
5. Self-assessments

Recommended Readings:

1. Conn E. E. and Stumpf, P. K. 2009. Outlines of Biochemistry, John Wiley and Sons Inc. New York.
2. Buchanan B. B, Gruissem W and Jones R. L. 2015. Biochemistry and Molecular Biology of Plants. John Wiley and Sons.
3. Nelson, D. L and Cox M. M. 2017. Lehninger Principles of Biochemistry. 7th edition. W. H. Freeman and Company. New York.
4. Voet, D. Voet J. G. and Pratt, C. W. 2016. Fundamentals of Biochemistry: Life at the Molecular level, 5th Edition. John Wiley and Sons, New York.
5. Dey, P. M. and Harborne, J. B. 1997. Plant Biochemistry. Harcourt Asia PTE Ltd. Singapore.
6. Smith, E L., Hill, R. L., Lehman, R. I., Lefkowits, R J. and Abraham. H. Principles of Biochemistry, (General Aspects). White. International Student Edition. McGraw Hill International Book Company.
7. Zubay. G. 2003, Biochemistry, MacMillan Publishing Co., New York.

8. Chesworth,. J. M., Strichbury T. and Scaife, J. R. 1998. An introduction to Agricultural Biochemistry. Chapman and Hall, London.
9. Mckee, T. and Mckee, J. R. 1999. Biochemistry – An Introduction. WCB / McGraw-Hill, New York, Boston, USA.
10. Taiz, L. and Zeiger, E. MØller, I M and Murphy A. 2014. Plant Physiology and Development. 6th Edition. Sinauer Associates, Inc.

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