

POOL OF DSEs

DISCIPLINE SPECIFIC ELECTIVE COURSE – (DSE-4) BIOCHEMICAL MECHANISMS AND RESPONSES IN PLANTS

CREDIT DISTRIBUTION, ELIGIBILITY AND PRE-REQUISITES OF THE COURSE

Course title & Code	Credits	Credit distribution of the course			Eligibility criteria	Pre-requisite of the course (if any)
		Lecture	Tutorial	Practical/ Practice		
Biochemical Mechanisms and Responses in Plants (BCH-DSE-4)	04	02	0	02	Class XII with Science and Biology	Basic courses allied to biological science

Learning Objectives

The course aims to provide thorough understanding of metabolic processes in plants and the role of different biosynthetic pathways in growth and development of plants. The course will also impart basic concepts and applications of plant secondary metabolites.

Learning outcomes

On successful completion of the course students will be able to:

1. Describe the structure and function of plant cell organelles in plant metabolism.
2. Explain the various plant biochemical processes and metabolic pathways including photosynthesis, photorespiration, nitrogen fixation and assimilation and plant secondary metabolism and their biological significance.
3. Discuss the role of plant hormones in plant growth and development.
4. Evaluate the various plant responses to different abiotic and biotic stress conditions.
5. Plan and execute plant tissue culture.

SYLLABUS OF DSE-4

BCH-DSE-4 : BIOCHEMICAL MECHANISMS AND RESPONSES IN PLANTS Semester – IV

2.2 Course Contents

Theory (Credits – 2)

Unit I: Photosynthesis and Respiration

Total Hours : 30
(8 Hours)

Introduction to Plant cells, Cell wall, Vacuole and Tonoplast membrane, Plastids and Peroxisomes. Overview to photosynthesis and Carbon assimilation, Light reaction and photosystems, Cyclic and non-cyclic photophosphorylation, Calvin cycle and its regulation, C4 cycle and Crassulacean acid metabolism (CAM), Photorespiration. Photoinhibition. Glycolytic pathway and its alternative reactions in plants, Translocation of metabolites across mitochondrial membrane, TCA cycle, electron transport chain in plants, alternative NAD(P)H oxidative pathways.

Unit II: Nitrogen metabolism

(7 Hours)

Nitrogen cycle; Biological nitrogen fixation; Structure and function of Nitrogenase complex. Nitrate assimilation: Nitrate and Nitrite reductase. Primary and secondary ammonia assimilation in plants; ammonia assimilation by glutamine synthetase-glutamine oxoglutarate aminotransferase (GS-GOGAT) pathway.

Unit III: Plant physiology and Secondary metabolites

(10 Hours)

Plant vascular system; Plant hormones and their role in plant growth and development; Regulation of plant morphogenetic processes by light. Plant stress responses to abiotic and biotic stresses: Water deficit, temperature, salinity, insect manifestation. Secondary metabolites: types, structure and functions of Alkaloids, Phenolics and terpenoids.

Unit IV: Plant tissue culture

(5 Hours)

Cell and tissue culture techniques, types of cultures: organ and explant culture, callus culture, cell suspension culture and protoplast culture. Plant regeneration pathways: organogenesis and somatic embryogenesis. Applications of cell and tissue culture and somaclonal variation. Germplasm storage and cryo-preservation. Brief introduction to transgenic plants.

2.3 Practical:

Credits: 2

Total Hours : 60

1. Induction of hydrolytic enzymes (proteases /amylases/lipase) in germinating wheat seeds.
2. Effect of plant hormones on plant growth (Phytochrome effects on lettuce germination/ Gibberellic acid effect on α -amylase secretion in barley seeds).
3. Extraction and assay of Urease from Jack bean.
4. Estimation of carotene/phenols/tannins in fruits and vegetables.
5. Estimation of ascorbic acid in fruits and vegetables.
6. Effect of light on chlorophyll production.
7. Separation and analysis of chloroplast proteins (Rubisco) using SDS-PAGE.
8. Plant tissue culture

2.4 Essential readings:

1. Buchann (2015). Biochemistry and Molecular Biology of plant. (2nd ed.). I K International. ISBN-10: 8188237116, ISBN- 978047 07 14218
2. Caroline Bowsher, Martin steer, Alyson Tobin (2008). Plant Biochemistry. Garland Science. ISBN 978-0-8153-4121-5.

3. Dey, P. M. and J.B. Harborne, J.B., (Editors) (1997). Plant Biochemistry. Academic Press. ISBN-10:0122146743, ISBN-13:978-0122146749. 94
4. Taiz, L. and Zeiger, E. (2010). Plant Physiology (5th ed.). Sinauer Associates Inc. ISBN-13: 978-0878938667, ISBN-10: 0878938664

4. Keywords

Plant cell, photosynthesis, respiration, nitrogen fixation and assimilation, secondary metabolism, stress biology.

Note: Examination scheme and mode shall be as prescribed by the Examination Branch, University of Delhi, from time to time.

DISCIPLINE SPECIFIC ELECTIVE COURSE – (DSE-5) NUTRITIONAL BIOCHEMISTRY

CREDIT DISTRIBUTION, ELIGIBILITY AND PRE-REQUISITES OF THE COURSE

Course title & Code	Credits	Credit distribution of the course			Eligibility criteria	Pre-requisite of the course (if any)
		Lecture	Tutorial	Practical/ Practice		
Nutritional Biochemistry (BCH-DSE-5)	04	02	0	02	Class XII with Science and Biology	Basic courses allied to biological science

Learning Objectives

This course provides students with knowledge and understanding of the characteristics, function, metabolism and deficiency of macro and micronutrients in the human body. It involves integrated learning between the areas of Biochemistry and Nutrition.

Learning outcomes

On successful completion of the course students will be able to:

1. Critically analyse and evaluate concepts in nutritional biochemistry that are important for an understanding of human nutrition.
2. Demonstrate the relationship between nutrition and health.
3. Discuss the macro and micronutrients and their nutritional deficiencies.
4. Describe techniques used in the assessment of nutritional status and nutritional disorders.
5. Explain drug nutrient interactions.

SYLLABUS OF DSE-5

BCH-DSE-5 : NUTRITIONAL BIOCHEMISTRY Semester – IV

2.2 Course Contents

Theory (Credits – 2)

Total Hours: 30

Unit I: Introduction to Nutrition and Energy Metabolism (4 Hours)

Defining nutrition, role of nutrients. Unit of energy, Food energy, SDA. Energy expenditure and its components, Energy Balance, Recommended Nutrient Intakes (RNI) and Recommended Dietary Allowances for different age groups.

Unit II: Macronutrients (10 Hours)

Food sources of carbohydrates, functions of carbohydrates, RDA, Factors affecting bioavailability, Glycemic index and glycemic load. Dietary fiber and the role of fibre in health. Role of Gut microbiome in maintaining health. Role of prebiotics and probiotics in nutritive health.

Essential Fatty Acids; Functions of EFA, AI, excess and deficiency of EFA, factors affecting bioavailability. Dietary implications of ratios of n6 and n3, MUFA, PUFA and SFA, Cholesterol in the body.

Functions of proteins in the body. RDA for different age groups. Essential and Nonessential amino acids. Complete and incomplete protein, Amino Acid Interactions: Antagonism, Toxicity, Imbalance, Amino acid complementation and Supplementation in foods. Protein quality determinants NPU, Biological Value, PDCAAS, Nitrogen balance. PEM: Marasmus and Kwashiorkor.

Unit III: Fat and water soluble Vitamins (9 Hours)

Vitamin A, D, E, K and dietary sources, RDA, Role of Vitamin A in Visual cycle and overview of other functions. Role of Vitamin K in Gamma carboxylation (blood clotting). Role of Vitamin E as an antioxidant. Role of Vitamin D in maintenance of bone physiology and overview of other functions. Vitamin C- Dietary sources, RDA, role in collagen synthesis. The B Complex vitamins- Dietary sources, RDA. Functions and role in metabolism, Role of Vitamin B12 and Folate in Haematopoiesis and Neurology. Biochemical basis for deficiency symptoms, Hypervitaminosis.

Unit IV: Minerals (7 Hours)

Minerals: Dietary Sources, RDA. Sodium, Potassium, Calcium, Iron, Chloride, Copper and Phosphorus- Function, metabolism, Excretion, Deficiency, Toxicity, Trace Elements Iodine, Fluoride, Mg, Zn, Se, Chromium, Molybdenum: Function, Metabolism, deficiency, Toxicity and Sources.

2.3 Practical:

Credits: 2

Total Hours: 60

1. Anthropometric identifications for nutrition related diseases, BMR calculation
2. Determination of oxidative stress: TBARS in serum, antioxidant enzymes in hemolysate/plant sources.
3. Estimation of A/E vitamin in serum.
4. Estimation of minerals in drugs/food/serum.
5. Determination of nutritive value of foods.
6. Understanding fortification and supplementation
7. Presentation and discussion on Food as medicine.
8. Group discussion on Nutrient-nutrient and drug-nutrient interactions
9. Case studies on nutritional disorders.

2.4 Essential readings:

1. Coombs Jr. G. F., (2008). *The vitamins, Fundamental aspects in Nutrition and Health*. Elsevier's Publications. ISBN-13- 978-0-12- 183493-7.
2. Mahan, L.K., Strings, S.E., Raymond, J. (2012) *Krause's Food and Nutrition Care process*. Elsevier's Publications. ISBN: 978-1-4377-2233-8.
3. Rosalind Gibson (2005). *Principles of Nutritional Assessment*. Oxford University Press. ISBN: 9780195171693
4. Tom Brody (1999). *Nutritional Biochemistry* (2nd Ed). Harcourt Braces. ISBN:9814033251, 978981403325.
5. Malik, D., Narayanasamy, N., Vavilala, P., Takur, J., Sinha, N., (2022). *Textbook of Nutritional Biochemistry*. Springer Singapore, ISBN978-981-19-4149-8.

Suggested reading:

1. Devlin, T. M., (2011). *Textbook of Biochemistry with Clinical Correlations*. John Wiley & Sons, Inc. (New York), ISBN: 978-0-4710-28173-4.

3. Keywords

Nutrition, macronutrients, micronutrients, energy balance, nutrient deficiency

Note: Examination scheme and mode shall be as prescribed by the Examination Branch, University of Delhi, from time to time.