

Annexure A

Semester	Course Code	Course Title	Nomenclature	Credits
I	UG-BCH-101	Molecules of Life	DSC	4
	UG-BCH-102	Cell Biology	DSC	4
	UG-BCH-MDC1	Contemporary Nutrition	MDC	3
	UG-BCH-SEC1	Basic Microbiology	SEC	3
II	UG-BCH-103	Protein Chemistry	DSC	4
	UG-BCH-104	Concepts in Genetics	DSC	4
	UG-BCH-MDC2	Human Health and Diseases	MDC	3
	UG-BCH-SEC2	Nutraceutical Product Development	SEC	3
III	UG-BCH-201	Tools & Techniques in Biochemistry	DSC	4
	UG-BCH-202	Biophysics	DSC	4
	UG-BCH-MDC3	Food Science and Technology	MDC	3
	UG-BCH-SEC3	Bioprospecting and Bioremediation	SEC	3
IV	UG-BCH-203	Metabolism of Biomolecules	DSC	4
	UG-BCH-204	Fundamentals of Microbiology	DSC	4
	UG-BCH-205	Human Physiology	DSC	4
	UG-BCH-206	Molecular Biology	DSC	4
	UG-BCH-VOC1	Clinical and Laboratory Diagnosis	VOC	4
V	UG-BCH-207	Enzymology	DSC	4
	UG-BCH-208	Clinical Biochemistry	DSC	4
	UG-BCH-209	Fundamentals of Immunology	DSC	4
	UG-BCH-VOC2	Quality Assurance and Quality Control	VOC	4
VI	UG-BCH-210	Industrial Biochemistry	DSC	4
	UG-BCH-211	Introduction to Pharmacology	DSC	4
	UG-BCH-212	Nutritional Biochemistry	DSC	4
	UG-BCH-213	Genetic engineering and Biotechnology	DSC	4
	UG-BCH-VOC3	Instrumentation in Health Science	VOC	4
VII	UG-BCH-301	Environmental Chemistry	DSC	4
	UG-BCH-302	Bioinformatics	DSC	4
	UG-BCH-303	Advanced Cell Biology	DSC	4
	UG-BCH-304	Endocrinology	DSC	4
VIII	UG-BCH-305	Regulation of Gene Expression	DSC	4
	UG-BCH-306	Plant Biochemistry	DSC	4
	UG-BCH-307	Advanced Immunology	DSC	4
	UG-BCH-308	Haematology and Toxicology	DSC	4

***Implementation of fourth year (Semester VII & VIII) is subject to approval from DHE**

**Parvatibai Chowgule College of Arts and
Science**

(Autonomous)

DEPARTMENT OF BIOCHEMISTRY

B.Sc. DEGREE COURSE

IN BIOCHEMISTRY

Annexure B

B.S.C. DEGREE COURSE IN BIOCHEMISTRY - COURSE STRUCTURE

Applicable from the academic year 2023-24

SEMESTER	CORE (Major)				CORE (Minor)/VOC	MDC	SEC
I	UG-BCH-101 Molecules of Life				UG-BCH-102 Cell Biology	UG-BCH-MDC1 Contemporary Nutrition	UG-BCH-SEC1 Basic Microbiology
II	UG-BCH-103 Protein Chemistry				UG-BCH-104 Concepts in Genetics	UG-BCH-MDC2 Human Health and Diseases	UG-BCH-SEC2 Nutraceutical Product Development
III	UG-BCH-201 Tools & Techniques in Biochemistry	UG-BCH-202 Biophysics			UG-BCH-201 Tools & Techniques in Biochemistry	UG-BCH-MDC3 Food Science and Technology	UG-BCH-SEC3 Bioprospecting and Bioremediation
IV	UG-BCH-203 Metabolism of Biomolecules	UG-BCH-204 Fundamentals of Microbiology	UG-BCH-205 Human Physiology	UG-BCH-206 Molecular Biology	UG-BCH-VOC1 Clinical and Laboratory Diagnosis		
V	UG-BCH-207 Enzymology	UG-BCH-208 Clinical Biochemistry	UG-BCH-209 Fundamentals of Immunology		UG-BCH-VOC2 Quality Assurance and Quality Control		
VI	UG-BCH-210 Industrial Biochemistry	UG-BCH-211 Introduction to Pharmacology	UG-BCH-212 Nutritional Biochemistry	UG-BCH-213 Genetic engineering and Biotechnology	UG-BCH-VOC3 Instrumentation in Health Science		
VII	UG-BCH-301 Environmental Chemistry	UG-BCH-302 Bioinformatics	UG-BCH-303 Advanced Cell Biology	UG-BCH-304 Endocrinology	UG-BCH-304 Endocrinology		
VIII	UG-BCH-305 Regulation of Gene Expression	UG-BCH-306 Plant Biochemistry	UG-BCH-307 Advanced Immunology	UG-BCH-308 Haematology and Toxicology	UG-BCH-306 Plant Biochemistry		

UG-BCH-101: MOLECULES OF LIFE

COURSE TITLE: MOLECULES OF LIFE (THEORY)

COURSE CODE: UG-BCH-101

MARKS: 75

CREDITS: 3

TOTAL HOURS: 45

Course objective:

Course involves the study of origin of life and the chemistry of water and importance of it to life forms on earth. The main focus of this course is the study of structure, classification and application of biomolecules such as Carbohydrates, Proteins, Lipids, Nucleic acid, enzymes and vitamins.

Course Outcomes:

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

CLO1: Gain an understanding of the various theories of the origin of life.

CLO2: Comprehend the importance of water in the sustenance of life.

CLO3: Compare and contrast the various biomolecules (carbohydrates, proteins, lipids, nucleic acids, vitamins), their categories as well as functions.

CLO4: Understand and apply general laboratory safety measures as well as calculate for preparation of various chemicals for experiments.

CLO5: Prepare different solutions such as buffers, reagents and stock solutions for experiments independently.

UG-BCH-101: MOLECULES OF LIFE (THEORY)

Module I (15 hrs)

The foundations of Biochemistry - 2 hrs

Chemical and cellular foundations of life

Water - 3 hrs

Unique properties of water; Weak interactions in aqueous systems; Ionization of water; Water as a reactant and fitness of the aqueous environment.

Carbohydrates - 10 hrs

Classification of carbohydrates; Monosaccharides - structures of aldoses and ketoses, the ring structure of sugars, conformations of sugars; Stereochemistry: mutarotation, anomers, epimers, and enantiomers; The formation of disaccharides; Reducing and non-reducing disaccharides; Polysaccharides: homo and heteropolysaccharides; Structural and storage polysaccharides; Glycoconjugates; Functions of carbohydrates

Module II (15 hrs)

Proteins – 8 hrs

Amino acids - structure, classification; Derivatives of amino acids and their biological role. Titration of amino acids; Introduction to biologically important peptides; Polypeptides and proteins.

Lipids - 7 hrs

Classification of lipids and their distribution; Storage lipids; Structural lipids; Lipids as signaling molecules, cofactors and pigments

Module III (15 hrs)

Nucleic Acids – 10hrs

Nucleotides and nucleic acids, phosphodiester bond; Nucleic acid structure and chemistry: DNA as genetic material; DNA structures and their importance, unusual DNA structures; Different types of RNA; Other functions of nucleotides: a source of energy, a component of coenzymes, second messengers.

Vitamins – 5hrs

Structure and active forms of water soluble and fat-soluble vitamins; Deficiency diseases and symptoms; Hypervitaminosis

COURSE TITLE: MOLECULES OF LIFE (PRACTICAL)

COURSE CODE: UG-BCH-101

MARKS: 25

CREDITS: 1

TOTAL HOURS: 30

1. Introduction to safety measures in laboratories
2. Preparation of buffers & solutions (normal, molar, ppm, %)
3. Mutarotation of sugars
4. Qualitative tests for carbohydrates, lipids, proteins, and nucleic acids
5. Generation of calibration curve: Estimation of reducing sugars by DNSA method
6. Determination of pKa of amino acids
7. Preparation of TLC plates and separation of amino acids and sugars by thin layer chromatography
8. Determination of peroxide value of oil

REFERENCES

Mandatory Reading

- Nelson, D. L. & Cox, M.M. (2000), Lehninger's Principles of Biochemistry (3rd Edition), Worth Publishers, New York, USA.

Supplementary Reading

- Stryer, L. (1995). Biochemistry, W.H. Freeman and Co., New York, USA.
- Jain, J.L (1999), Fundamentals of Biochemistry, S.Chand and Company, Ltd., New Delhi.
- Murray, R.K, Granner, D.K, Mayes, P.A. & Rodwell, V.W. (2003), Harper's Illustrated Biochemistry, McGraw-Hill Companies.
- Sadasivam, S. and Manickam, A. (1996), Biochemical Methods, New Age International Limited
- Jayaraman, J. (1971), Laboratory Manual in Biochemistry, John Wiley & Sons, Limited.
- Plummer, D.T. (1993). An Introduction to Practical Biochemistry, Sixth Reprint. Tata McGraw-Hill Publishing Company Limited, New Delhi.
- Harvey, R.A. & Ferrier, D.R. (2011). Lippincott's Illustrated Reviews, Biochemistry Fifth Edition, Lippincott Williams and Wilkins.

WEB REFERENCES

1. <https://www.khanacademy.org/science/biology/macromolecules>
2. <https://egyankosh.ac.in/bitstream/123456789/68502/1/Block-1.pdf>
3. <https://www.coursera.org/lecture/life-on-other-planets/simple-ingredients-AI598>

UG-BCH-102: CELL BIOLOGY

COURSE TITLE: CELL BIOLOGY (THEORY)

COURSE CODE: UG-BCH-102

MARKS: 75

CREDITS: 3

TOTAL HOURS: 45

Course Objective:

This course deals with an introduction to cell biology, prokaryotic and eukaryotic cells. Students will study about the Cell wall and Plasma membrane composition, structure and function of organelles found in the cells. It also includes the cell cycle, mitosis and meiosis along with the different types of cell-cell interactions.

Course Outcome:

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

CLO1: Demonstrate an understanding of cell communication.

CLO2: Correlate the function of each cell organelle with proper coordination.

CLO3: Identify and analyze different biological cells using a compound microscope.

CLO4: Prepare various plant and animal specimen for the observation of cell structures.

UG-BCH-102: CELL BIOLOGY (THEORY)

Module I (15 hrs)

Introduction to cell biology - 6 hrs

Cell theory; ultrastructure of prokaryotic and eukaryotic cell; cell matrix proteins; components of the extracellular matrix.

Cell wall & Plasma membrane - 9 hrs

Chemical composition; structure and functions of the cell wall and plasma membrane; monolayer; planar bilayer and liposomes as model membrane systems; Fluid mosaic model; lipid rafts; membrane fluidity; factors affecting membrane fluidity; techniques used to study membranodynamics – FRAP.

Module II (15 hrs)

Ultrastructure and function of organelles – 15 hrs

Cilia and Flagella; Endoplasmic reticulum; Golgi apparatus; Lysosomes; Microbodies; Mitochondria; Ribosomes; Centrioles and basal bodies; Nucleus; Chloroplasts and Peroxisomes.

Module III (15 hrs)

Cell Cycle – 6 hrs

Overview of the cell cycle; prokaryotic & eukaryotic cell cycle; events of mitotic & meiotic phases, cytokinesis.

Cell-Cell interaction – 9 hrs

Interactions of cells with extracellular materials: integrins, focal adhesions, and hemidesmosomes; interactions of cells with other cells: selectins, the immunoglobulin superfamily, cadherins, adherens junctions, and desmosomes; tight junctions, gap junctions, and plasmodesmata.

COURSE TITLE: CELL BIOLOGY (PRACTICAL)

COURSE CODE: UG-BCH-102

MARKS: 25

CREDITS: 1

TOTAL HOURS: 30

1. Examination of a prokaryotic cell, eukaryotic cell and cell organelles using photomicrographs
2. Visualization of animal and plant cell using methylene blue
3. Study of cell viability using phenol red/trypan blue
4. Visualization of Permanent slides of different cell types: Epithelium, Endothelium, Muscle cells, Nerve cell
5. Identification of different stages of mitosis in onion root tip
6. Identification of different stages of meiosis in onion flowerbuds
7. Isolation of chloroplast from spinach leaves
8. Prokaryotic cell harvesting & lysis using osmotic (salt) and Chemical (detergent) methods

REFERENCES

Mandatory Reading

- Karp, G. & Harris, D. (2008) Cell and Molecular Biology – Concepts and Experiments, John Wiley & Sons Inc, New York.

Supplementary Reading

- Robertis, E.D.P. & Robertis, E.M.F. (1998). Cell Biology and Molecular Biology, 8th edition, Sauder College.
- Cooper, G.M. and Hausman, R.E. 2009. The Cell: A Molecular Approach. 5th edition. ASM Press & Sunderland, Washington, D.C.
- Verma P.S. and Agarwal V. K. (1998). Cell Biology, Genetics, Molecular Biology, Evolution, and ecology. 14th edition.

WEB REFERENCES

1. <https://www.udemy.com/course/basics-on-cell-biology/>
2. https://onlinecourses.nptel.ac.in/noc22_bt33/preview
3. <https://www.coursera.org/learn/the-little-stuff-energy-cells-and-genetics>

UG-BCH-103: PROTEIN CHEMISTRY

COURSE TITLE: PROTEIN CHEMISTRY (THEORY)

COURSE CODE: UG-BCH-103

MARKS: 75

CREDITS: 3

TOTAL HOURS: 45

Course Outcome:

This course contains a detailed study of proteins – right from the various levels of protein structure, methods in determining the various levels of protein structure and purification of proteins. The course also will help the students in understanding how proteins are characterized. The course also contains a study of membrane and transport proteins and an introductory unit on enzymes.

Course Outcome:

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

CO1: Comprehend the various levels of protein structure.

CO2: Explain the mechanism and significance of membrane proteins.

CO3: Correlate the techniques used in studying protein structure.

CO4: Review enzymes and their classification system.

CO5: Assess and compare the various methods employed in protein estimation/concentration and measuring the protein content.

UG-BCH-102: PROTEIN CHEMISTRY (THEORY)

Module I (15 hrs)

Protein Structure - 15 hrs

Bonds in protein structure (covalent, non-covalent, peptide), importance of primary & secondary structure, tertiary and quaternary structures, bond lengths and configuration, Dihedral angles, psi and phi, helices, sheets and turns, Ramachandran map; techniques used in studying 3-D structures - X-ray diffraction and NMR; motifs and domains; structures of myoglobin and haemoglobin, multimeric proteins and conjugated proteins, diversity of function.

Module II (15 hrs)

Isolation & analysis of protein – 12 hrs

Techniques to isolate and analyze proteins: salt fractionation, ion-exchange chromatography, gel permeation, HPLC, Native and SDS-PAGE, IEF; Protein primary structure: sequencing by Edman degradation, the use of enzymes and chemical reagents to obtain overlap peptides, synthesis of peptides using Merrifield method.

Characterization of proteins – 3 hrs

Determination of purity, molecular weight, extinction coefficient, sedimentation coefficient, 2-D electrophoresis

Module III (15 hrs)

Enzymes – 6 hrs

Nature of enzymes: protein and non-protein (ribozyme); cofactor and prosthetic group, apoenzyme, holoenzyme;

IUBMB classification of enzymes; Activation energy of enzymes.

Membrane and Transport proteins – 9 hrs

Integral and membrane-associated proteins, hydropathy plots to predict transmembrane domains; the significance of functional proteins - bacteriorhodopsin, myoglobin, and hemoglobin: structure and function (Oxygen binding curves, cooperativity models for hemoglobin)

COURSE TITLE: PROTEIN CHEMISTRY (PRACTICAL)

COURSE CODE: UG-BCH-103

MARKS: 25

CREDITS: 1

TOTAL HOURS: 30

1. Determination of absorption maxima and molar extinction coefficient of protein sample
2. Protein Assay (Biuret/Lowry/Bradford method)
3. Ammonium sulfate fractionation of proteins
4. Protein Dialysis
5. The solubility of proteins in distilled water and salt solutions
6. Denaturation of proteins by pH and temperature
7. Separation of proteins by SDS-PAGE (demonstration)
8. Gel filtration chromatography (demonstration)

REFERENCES

Mandatory Reading

- Nelson D.L and Cox M.M (2013). Lehninger's Principles of Biochemistry, Worth Publishers, New York, USA.

Supplementary Reading

- Cooper T.G (2011). The Tools of Biochemistry, Wiley India Pvt. Ltd, New Delhi.
- Voet, D. and Voet, J.G (2004). Biochemistry, 3rd Edition, John Wiley & Sons, Inc. USA.
- Plummer D. T (1998). An Introduction to Practical Biochemistry, 3rd ed., Tata McGrawHill Education Pvt. Ltd. New Delhi.
- Sadasivam S. and A. Manickam (1996), Biochemical Methods, New Age International Limited, New Delhi.
- J. Jayaraman (1971), Laboratory Manual in Biochemistry, John Wiley & Sons, Limited, New Delhi.

WEB REFERENCES

1. https://onlinecourses.nptel.ac.in/noc21_bt48/preview
2. <https://www.edx.org/course/proteins-biologys-workforce>
3. <https://www.udemy.com/course/enzymology/>

UG-BCH-104: CONCEPTS IN GENETICS

COURSE TITLE: CONCEPTS IN GENETICS (Theory)

COURSE CODE: UG-BCH-104

MARKS: 75

CREDITS: 3

TOTAL HOURS: 45

Course objectives:

This course looks into the aspects of classical genetics – it provides an insight into Mendelian Genetics, Linkage and crossing over during meiosis. Students will be able to understand how genetic exchanges occur in microorganisms as well as the popular choices of organisms for the study of genetics. The course will enable the students to understand human genetics and various genetic disorders that occurs in human as well as mechanisms of sex determination. The course also contains a small unit on population genetics.

Course outcomes:

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

CO1: Describe the various chromosomal theories and Mendelian genetics.

CO2: Comprehend and analyse the pedigree chart and inheritance pattern in family

CO3: Correlate various genetic disorders to chromosomal mutations.

CO4: Explain the various sex-determining mechanisms in animals.

UG-BCH-104: CONCEPTS IN GENETICS (THEORY)

Module I (15 hours)

Mendelian Genetics - 8 hrs

Introduction to Classical genetics, terminologies.

History of Mendelian Genetics, First Law of Inheritance, Second Law of Inheritance, Monohybrid and Dihybrid cross, Test cross, and Back cross and their significance. Deviations in Mendel's Laws: Dominance, Co-dominance, Incomplete dominance; Multiple alleles: ABO blood group, Rh incompatibility

Gene interaction - Epistasis: Dominant and Recessive epistasis with examples; Non-epistatic gene interactions

Model Organisms in Genetics - 2 hrs

Escherichia coli, *Saccharomyces cerevisiae*, *Neurospora crassa*, *Drosophila melanogaster*, *Caenorhabditis elegans*, *Arabidopsis thaliana*

Chromosomes - 2 hrs

Chromosome number; morphology; chromosome material and chemical composition; giant chromosomes.

Gene transfer Mechanisms in Bacteria - 3 hrs

Conjugation, Transformation, and Transduction

Module II (15 hours)

Linkage and crossing over - 9 hrs

Sutton-Boveri chromosome theory of heredity Bateson and Punnett's coupling and repulsion hypothesis, Morgan's views on linkage, Theory of linkage; Kinds of linkage: Complete linkage, incomplete linkage; Significance of linkage

Types of crossing over, Somatic or mitotic crossing over, Germinal or meiotic crossing over.

Mechanism of meiotic crossing over, Synapsis, Duplication of chromosomes, Crossing over by breakage and union, terminalisation, Significance of crossing over.

Transposable elements, Significance of crossing over.

Human Genetics - 6 hrs

Importance of human genetics study, techniques involved: Karyotyping Amniocentesis, CVS, Pedigree analysis; Human traits Disorders due to mutant genes: PTC tasters, Huntington's chorea, tongue rolling, hemophilia; genetic disorders (alkaptonuria, phenylketonuria, sickle cell anemia)

Module III (15 hours)

Chromosomal mutations - 6 hrs

Concept of gene doses, Barr bodies, Types of structural changes (Deletion, Duplication, Inversion, Translocation, Variation in chromosome morphology). Disorders – Down's syndrome, Klinefelter's syndrome.

Types of numerical changes with examples (Euploidy and Aneuploidy) - Monosomy and Trisomy of Sex and Autosomes Disorders – Turner's syndrome, Cri-du-chat syndrome.

Disorders due to inborn errors of metabolism — Phenylketonuria (PKU), Alkaptonuria, Sickle-cell anemia.

Sex determination and differentiation - 6 hrs

Heterogametes; Types: Heterogametic males, Heterogametic females; Genic balance mechanism - Sex determination in *Drosophila melanogaster* and man; Male haploidy or haplo-diploidy mechanism; Hormonally controlled sex-determining mechanism - *Bonellia*; Environmentally controlled sex-determining mechanism - *Ophryotrocha*

Population Genetics - 3 hrs

Gene pool; theory of allele frequencies (gene and genotypic frequencies); Hardy-Weinberg law, Factors affecting Hardy Weinberg theory, Predicting allele and Genotype frequencies and exceptions to Hardy-Weinberg principle, Speciation: types and examples.

COURSE TITLE: CONCEPTS IN GENETICS (Practical)

COURSE CODE: UG-BCH-104

MARKS: 25

CREDITS: 1

TOTAL HOURS: 30

1. Study of a dissection microscope
2. Study of Barr bodies in sex determination
3. Study of Polytene chromosomes
4. Study of Mendelian traits in the human population
5. Problem-solving on Mendel's Laws & Hardy-Weinberg's Law
6. Karyotype analysis of chromosomal abnormalities
7. Pedigree analysis and problem-solving.
8. Bacterial conjugation

REFERENCES:

Mandatory Reading

- Tamarin, R.H. (2017). Principles of Genetics (7th Edition). Tata McGraw-Hill Publishing Company Ltd.

Supplementary Reading

- Verma, P. S. and Agarwal, V. K. (2013). Cell Biology, Genetics, Molecular Biology, Evolution and Ecology, S. Chand and Company Pvt. Ltd.

- Gardner, E. J., Simmons, M. J. & Snustad, D. P. (2013). Principles of Genetics, 8th Edition, John Wiley and Sons.
- Hotter, P. (2007). Dictionary of Genetics, IVY Publishing House, Delhi
- Harvey, R.A. & Ferrier, D.R. (2017). Lippincott's Illustrated Reviews, Biochemistry (7th Edition). Lippincott Williams and Wilkins.
- Lewin B., Krebs J. E., Goldstein E. S., and Kilpatrick S. T. Genes XI. Jones & Bartlett Publishers

WEB REFERENCES:

- <http://www.biologydiscussion.com/mendel/mendel-study-on-genetics-mendelian-inheritance/38754>
- <https://www.khanacademy.org/science/high-school-biology/hs-classical-genetics/hs-pedigrees/v/pedigrees>
- <https://study.com/academy/lesson/hardy-weinberg-equilibrium-i-overview.html>
- <http://www.biologydiscussion.com/genetics/structural-change-in-the-structure-of-chromosomes/5261>
- <https://www.khanacademy.org/science/high-school-biology/hs-classical-genetics/hs-sex-linkage/a/x-inactivation>
- <https://www.khanacademy.org/science/biology/classical-genetics/chromosomal-basis-of-genetics/a/discovery-of-the-chromosomal-basis-of-inheritance>
- <https://journals.sagepub.com/doi/full/10.1177/0962280215597579>
- <https://link.springer.com/article/10.1007/s10577-017-9562-z>
- <https://onlinelibrary.wiley.com/doi/abs/10.1111/mec.13736>
- <https://onlinelibrary.wiley.com/doi/abs/10.1002/em.21945>
- <https://www.genetics.org/content/203/2/699.short>

UG-BCH-MDC1: CONTEMPORARY NUTRITION

COURSE TITLE: CONTEMPORARY NUTRITION (THEORY)

COURSE CODE: UG-BCH-MDC1

MARKS: 50

CREDITS: 2

TOTAL HOURS: 30

Course Objective

This course aims to institute the fundamentals of nutrition to the students. It comprises of various concepts which includes, Nutrients, Energy, types of diets and food reactions.

Course Outcomes

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

CLO1: Understand and explain the fundamentals of nutrition.

CLO2: Comprehend the concept of energy in metabolism.

CLO3: Discuss the role of nutrition in health.

CLO4: Describe and design diet plans for different age groups.

UG-BCH-MDC1: CONTEMPORARY NUTRITION

Module I (15 hrs)

Introduction to nutrition- 2 hrs

Nutrients, Anti-nutrients, Recommended Dietary Allowance, National and International Regulatory Authorities (ICMR, NIN-NSI, FSSAI, IDA, EFSA, FDA).

Classes of Nutrients, sources and function- 6 hrs

Carbohydrates, Lipids, Proteins, Vitamins, Minerals, Water.

Energy: Units of Energy, Physical and- 2 hrs

Physiological Energy values, Basal Metabolic Rate (BMR)

Energy Malnutrition- 5 hrs

PEU- Marasmus, Kwashiorkor, PEU in adults. Overnutrition- Obesity, Vitamin and Mineral toxicity

Module II (15 hrs)

Eating disorders- 5 hrs

Anorexia nervosa, bulimia nervosa, Binge eating syndrome, Night eating syndrome, Female Athlete Triad.

Hidden Hunger and Nutritional Supplements- 3 hrs

Vitamin and Iron deficiency, Protein supplements, Nutraceuticals, Pro- and Prebiotics

Food Reactions – 2 hrs

Intolerance and Allergies.

Diets of the world – 5 hrs

Atkins diet, Intermittent fasting, Ketogenic diet, Vegetarian diet, Vegan diet, Weight Watchers diet, Paleo diet, Mediterranean diet, Detox diet, Risks of diet plans and Fad diets.

UG-BCH-MDC1: CONTEMPORARY NUTRITION (PRACTICAL)

COURSE TITLE: CONTEMPORARY NUTRITION (PRACTICAL)

COURSE CODE: UG-BCH-MDC1

MARKS: 25

CREDITS: 1

TOTAL HOURS: 30

1. Nutritional information of recipes and packaged food products
2. Case studies of food reactions (Lactose intolerance, Gluten allergy, Nut allergy, Soy allergy)
3. Formulating a Diet Plan for Sports Persons/Lactating mothers/Diabetic patients
4. Nutraceutical products – Survey of types and applications
5. Estimation of ascorbic acid
6. Estimation of proteins.
7. Estimation of carbohydrates.
8. Estimation of Fat.
9. Determination of BMR

REFERENCES

Mandatory Reading

- Wardlaw, G. M. and Smith A. M. Contemporary Nutrition, McGraw-Hill, New York

Supplementary Reading

- Voet, D. and Voet, J. G. Biochemistry John Wiley and Sons, Inc, USA.
- Gopalan, C. Nutritive Value of Indian Food, National Institute of Nutrition Hyderabad, India.
- Nutrient Requirements for Indians: Recommended Dietary Allowances and Estimated Average Requirements, ICMR, NIH, Ministry of Health and family Welfare, Government of India.
- Dietary Guidelines for Indians -A Manual by National Institute of Nutrition Hyderabad, India
- Mehra V. Nutritional Biochemistry, Sonali Publications, New Delhi, India
- Sharma D.C. and Sharma D. Nutritional Biochemistry, CBS Publishers, New Delhi, India
- WHO Study Group on Diet, Nutrition and Prevention of Noncommunicable Diseases & WorldHealth

Organization. (1990). Diet, nutrition and the prevention of chronic diseases: report of a WHO study group

Web References

- <https://www.coursera.org/learn/childnutrition>
- <https://www.coursera.org/learn/nutrition-pregnancy>
- <https://www.edx.org/course/introduction-to-food-health>

UG-BCH-MDC2: HUMAN HEALTH AND DISEASES

COURSE TITLE: HUMAN HEALTH AND DISEASES (THEORY)

COURSE CODE: UG-BCH.GEC2

MARKS: 50

CREDITS: 2

TOTAL HOURS: 60

Course Objective

The main aim of this course is to introduce the students to the different types of diseases which affect human health. Various domains are covered up under this course which include metabolic disorders, nutritional and lifestyle disorders, autoimmunity, disorders caused due to hormonal imbalances and a brief view of infectious diseases.

Course Outcomes

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

CLO1: Understand the mechanism of metabolic disorders.

CLO2: Identify management methods of lifestyle disorders.

CLO3: Comprehend the concepts of autoimmunity, hormonal imbalance and infectious diseases.

CLO4: Detect common diseases by laboratory analytical methods

UG-BCH-GEC2: HUMAN HEALTH AND DISEASES

Module I (15 hrs)

Nutritional deficiency-based diseases – 5 hrs

Kwashiorkor, Marasmus, Beri-beri, Scurvy, Pellagra, Anaemia, Night blindness, Rickets, Osteomalacia, Osteoporosis.

Lifestyle diseases – 5 hrs

Obesity, Cardiovascular diseases, Atherosclerosis, Diabetes mellitus-II, Inflammatory Bowel Disease (IBD).

Inborn errors of metabolism – 5 hrs

Alkaptonuria, Phenylketonuria, Glycogen and Lipid storage diseases, Clotting disorders.

Module II (15 hrs)

Autoimmune diseases- 7 hrs

Concepts in immune recognition - self and non-self-discrimination, organ specific autoimmune diseases – Hashimoto's thyroiditis, Grave's disease, Myasthenia Gravis; Systemic diseases - SLE, rheumatoid arthritis; Diabetes Mellitus-I.

Hormonal Imbalances- 4 hrs

Outline of hormone action and imbalances leading to disease - precocious puberty, hyper and hypopituitarism. Hyper and hypothyroidism. PCOS

Infectious diseases- 4 hrs

Viral infection (polio, Covid-19); Bacterial infections (diphtheria, cholera); Protozoan (Plasmodium and Entamoeba histolytica)

COURSE TITLE: HUMAN HEALTH AND DISEASES (PRACTICAL)

COURSE CODE: UG-BCH-GEC2

MARKS: 25

CREDITS: 1

TOTAL HOURS: 30

1. Determination of blood glucose
2. Determination of blood clotting time
3. Estimation of hemoglobin
4. Determination of ESR
5. Analysis of human blood pressure
6. Physical examination of urine
7. WBC counting
8. Differential staining
9. TSH test
10. Urine and blood calcium test
11. Case studies – COVID-19, Malaria, PCOS.

REFERENCES

Mandatory Reading

- Ananthanarayan R. and Paniker C. K. J. (2009) Textbook of Microbiology. 8th edition, University Press Publication

Supplementary Reading

- Berg, J. M., Tymoczko, J. L. and Stryer, L., Biochemistry (2012) 7th ed., W.H Freeman and Company (New York)
- Murray, R. K, Granner, D. K, Mayes, P.A. and Rodwell, V.W. (2003), Harper's Illustrated Biochemistry, McGraw-Hill Companies.
- Roitt, I. M. and Delves, P. J. (2001). Essential immunology (10th ed.). Malden, MA: Blackwell Science.
- Ellen Strauss, James Strauss. (2007) Viruses and Human disease (2nd ed.). Academic Press Publications.

Web References

- <https://www.nhs.uk/conditions/>
- <https://www.ncbi.nlm.nih.gov/books>
- <https://rarediseases.org/rare-diseases>
- <https://medic-journal.com/>

UG-BCH-SEC1: BASIC MICROBIOLOGY

COURSE TITLE: BASIC MICROBIOLOGY (THEORY)

COURSE CODE: UG-BCH-SEC1

MARKS: 50

CREDITS: 2

TOTAL HOURS: 30

Course Objective

The main aim of this course is to introduce the students to the vast world of Microbiology. This course covers a range of topics in Basic Microbiology from the historical perspective to the structure and composition of microorganisms, their interactions with the environment and their impact on humans.

Course Outcomes

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

CO1: Understand the scope and importance of Microbiology, classification schemes, microscopy, staining and culturing of microbes.

CO2: Discriminate between various groups of microorganisms and also comprehend the beneficial and harmful effects of each group of microorganisms.

CO3: Compare, analyse, apply the concepts of principle, working of microscopes types.

CO4: Adhere to strict laboratory safety measures to be followed in a microbiology laboratory.

CO5: Master skills in aseptic techniques as well comprehend the importance of cleaning and decontamination.

UG-BCH-SEC1: BASIC MICROBIOLOGY (THEORY)

Module I (15 hrs)

History and Scope of Microbiology - 2 hrs

Historical account from 16th – 19th century

Bacterial Classification - 5 hrs

Structure of Bacteria; taxonomic ranks; classification systems (Phenetic, Numerical, Phylogenetic); Bergey's Manual of Systematic/ Determinative Bacteriology.

Classification of Viruses and Fungi - 2 hrs

Habitat, Nutrition, Structure

Basics of Microscopy - 3 hrs

Principle of working of light microscope (Bright-field, Dark-field, Phase-contrast, Fluorescence).

Stains and Staining – 3 hrs

Principles of staining, simple staining, negative staining, differential staining

Module II (15 hrs)

Organization of Microbiology Laboratory – 3 hrs

Aseptic techniques and Laboratory rules, Basic requirement of Microbiology Laboratory, Cleaning of Glass Wares, Plugging and Sterilization, Personal Hygiene.

Preparation of Media - 4 hrs

Types of culture media: synthetic/defined, complex solid, liquid, enrichment, selective, differential, broth and

agar media.

Isolation techniques and maintenance of microorganisms - 8 hrs

Isolation by: Micromanipulator, exposure to air, streak plate technique, spread plate technique, pour plate technique, serial dilution technique. Culture maintenance and preservation: Lyophilization, storage at -70°C, storage in liquid nitrogen, storage on glass beads at -60°C to -70°C, storage in gelatin disc, storage by subculturing, storage in mineral oil.

COURSE TITLE: BASIC MICROBIOLOGY (PRACTICAL)

COURSE CODE: UG-BCH-SEC1

MARKS: 25

CREDITS: 1

TOTAL HOURS: 30

1. Introduction to laminar air flow unit, autoclave, pH meter, incubator, microwave & microscope
2. Preparation and sterilization of glassware
3. Preparation of media and autoclaving
4. Preparation of agar plates and open-air cultures
5. Serial dilution technique and spread plating
6. Bacterial isolation techniques: streaking methods such as T-streak, quadrant.
7. Preparation and staining of specimen- simple staining, Gram staining.

REFERENCES

Mandatory Reading

- Pelczar, M.J., Chan E, C.S. Krieg, N.R. (1993). Microbiology, McGraw Hill Publishers.
- Purohit, S.S. Microbiology (Fundamentals and Applications), Agrobios Publishers.

Supplementary Reading

- Powar, C.B. and Daginawala, H.F. General Microbiology, Himalayan Publishers.
- Dubey, R.C. and Maheshwari, D.K. A Textbook of Microbiology, Chand Publishers
- Anantnaryan, Paniker, C.K.J. (2005). Textbook of Microbiology, 7th edition, Orient Blackswan.
- Aneja, K. R. (2007). Experiments in Microbiology, Plant Pathology and Plant Tissue Culture, New Age International.
- Gunasekaran, P. (1995). Laboratory Manual in Microbiology, New Age International.
- Madigan, M. T., Martinko. J. M. & Parker J. (2007). Brock's Biology of Microorganisms, Pearson Prentice Hall.
- Stanier, R.Y. (1993) General Microbiology, Cambridge University.
- Willey, J. M., Sherwood, L., Woolverton, C. J. & Prescott, L. M. (2008). Prescott, Harley, and Klein, Microbiology, New York, McGraw-Hill Higher Education.

WEB REFERENCES

1. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5524440/> (History of Microbiology)
2. [https://microbeonline.com/streak-plate-method-principle-purpose-procedure-results/\(Streaking\)](https://microbeonline.com/streak-plate-method-principle-purpose-procedure-results/(Streaking))
3. <https://www.khanacademy.org/science/biology/bacteria-archaea> (Bacteria and Archaea)
4. <https://www.khanacademy.org/science/biology/bacteriaarchaea/prokaryotemetabolismecolog/a/prokaryote-classification-and-diversity> (Prokaryotic Taxonomy)

UG-BCH-SEC2: NUTRACEUTICAL PRODUCT DEVELOPMENT

COURSE TITLE: NUTRACEUTICAL PRODUCT DEVELOPMENT (THEORY)

COURSE CODE: UG-BCH-SEC2

MARKS: 50

CREDITS: 2

TOTAL HOURS: 30

Course Objective

The main aim of this course is to introduce the students to the concept of nutraceuticals and the nutraceutical industry. The students will learn the process of nutraceutical product development.

Course Outcomes

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

CLO1: Explain the concept of nutraceuticals and functional foods.

CLO2: Extract and estimate bioactive compounds from plant and animal sources.

CLO3: Discuss the trends in the nutraceutical industry.

CLO4: Understand the process of nutraceutical product development.

UG-BCH-SEC2: NUTRACEUTICAL PRODUCT DEVELOPMENT (THEORY)

Module I (15 hrs)

Introduction to Nutraceutical - 5 hrs

Definition and Classification, dietary supplements, novel foods, post-biotics, fortified foods and functional foods. Indian and global scenario. Cosmeceuticals and aquaceuticals

Role of Nutraceuticals in human health - 5 hrs

Effect of nutraceuticals on Obesity, Diabetes, Cancer, Osteoarthritis, and degenerative disease. Immunity modulation and prevention of diseases with nutraceuticals.

Product development – 5 hrs

Stages of product development. Efficacy, Safety and Toxicity of nutraceuticals, Regulatory bodies, QC, QA, FSSAI

Module II (15 hrs)

Chemical structure, source, biological effect, bioavailability, dosage forms of:

Plant based nutraceuticals – 8 hrs

Allicin, Anthocyanins, Capsaicin, Curcumin, Epigallocatechin, Ginsenosides from Ginseng, Lycopene, Omega 3 fatty acids from Flaxseeds and Quercetin.

Animal based nutraceuticals – 5 hrs

Conjugated Linoleic Acid, Chondroitin sulphate, Glucosamine, Omega 3 fatty acids from fish.

Marine nutraceuticals – 3 hrs

Chitin, chitosan, Lipids, polysaccharides and pigments from marine algae.

COURSE TITLE: NUTRACEUTICAL PRODUCT DEVELOPMENT (PRACTICAL)

MARKS: 25

CREDITS: 1

TOTAL HOURS: 30

1. Extraction and quantification of phenolics from plants and spices.
2. Antioxidant activity assay- DPPH method
3. Extraction of chitin and chitosan production from seafood waste and fungi.
4. Case studies of nutraceutical products: paediatric/geriatric/probiotic/supplements during pregnancy/protein supplements/diabetes

REFERENCES

Mandatory Reading

- A.P. Sarkate, M.A. Patil and P.V. Agharde, (2021) Nutraceuticals and Human Health. Brillion Publishing. New Delhi, India.

Supplementary Reading

- Pathak Y. V. (2009) Handbook of Nutraceuticals Volume I- Ingredients, Formulations, and Applications CRC Press, Florida, USA
- Gupta, R.C. (2016) Nutraceuticals- Efficacy, safety and Toxicity. Elsevier, Massachusetts, USA.

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2. New Concepts in Nutraceuticals as Alternative for Pharmaceuticals
<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4336979/>
3. <https://www.escardio.org/Journals/E-Journal-of-Cardiology-Practice/Volume-9/Nutraceuticals-what-they-are-and-how-they-work>
4. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4336979/>