

B.Sc. (Hons.) - LIFE SCIENCES

SYLLABUS

1st & 2ND SEMESTERS

(2024-2025)

B.Sc. (Hons.) - LIFE SCIENCES

Preamble:

Life Sciences focus on studying the dynamic, variable, and complex living systems. This is a broad field that includes the study of living things pertaining to the molecules, the cellular structures and the complexity of the system. It will also study the interaction of organisms with the environment.

Understanding the basics of life sciences is very important for the students who aspire to pursue their academic career in biological science, which includes health, agriculture, environment, biotechnology, food technology, drug discovery and other allied fields. This is a highly dynamic and ever expanding field of science and technology requiring constant revision and adaptation of new and cutting edge knowledge in the field.

This program will train graduates in problem solving relating to the life sciences and environment through in depth understanding of the field. Graduates will be empowered to do problem solving through critical thinking innovation.

* Admission Requirements

> Pass in +2 in science and biology as one of the subjects.

Exit options

- Completion of 1 year (2 semesters) Certificate in Life Sciences
- Completion of 3 year (6 semesters) B.Sc., in Life Sciences

PONDICHERRY UNIVERSITY

School of Life Sciences

NEP FYUG As on Mar 25th 2024

Semester	Major	Minor	Multi- disciplinary	Ability Enhancement	Skill Enhancement	Value added	Summer Internship	Community Engagement	Research Project	Total credits
				Courses (Language)	courses	courses		and Service		
I	Biological Sciences (4) (BT)	Fundamentals of Nutrition (4) (FST) Fundamentals of Ecology (4) (EE)	Climate Change and Sustainability (3) (EE)	University Common Course (UCC)	Applications of Computer in Biology (3) (BI) Biochemical Lab Skills (3) (BMB)	UCC	NA	NA	NA	
Credits	4	4	3	3	3	4				21
II	Biomolecules (3+1P) (BMB)	Genetics (4) (BMB) Nutraceuticals and Functional Foods (4) (FST)	Concepts in Programming Languages (3) (BI)	UCC	Molecular Diagnostics (3) (BT) Extruded Snack Technology (3) (FST)	UCC	NA	NA	NA	
Credits	4	4	3	3	3	4				21
		Exit optio	n after 40 credi	ts: UG Certific	ate provided secure	4 credits	of internship			
I11	Cell Biology (3+1P) (BMB)	Biological Data and Databases	Lifestyle Diseases (3)	UCC	Quality Control in Microbiology (3)	NA	NA	NA	NA	

		(4) (BI)	(BMB)		(MB)					
	General Microbiology (3+1P) (MB)	Food Microbiology and Food Safety (4) (FST)								
Credits	8	4	3	3	3					21
IV	Molecular Biology (3+1P) (BMB) Techniques in Life Sciences (3+1P) (BT) Food Processing and Preservation (4) (FST)	Environmental Toxicology (4) (BT) Intermediary Metabolism (4) (BMB) Industrial Microbiology (4) (MB)	NA	UCC	NA	NA	NA	CES	NA	
Credits	12	4		3				2		21
		Exit optic	on after 80 cred	its: UG Diplon	na provided secure 4	credits of	internship			
V	Evolutionary Biology (4) (EE) Biological Sequence analysis (4) (BI) Food Chemistry (3+1P) (FST)	Virology (4) (MB) Environmental Policy and Management (4) (EE)	NA	NA	NA	NA	Summer Internship	NA	NA	

Credits	12	4					4			20
VI	Immunology (3+1P) (MB) Cancer Biology (4) (BT) Nutritional Biochemistry (4) (FST) Genomics & Proteomics (4) (BI)	Microbial Genomics (4) (MB) Natural Resource Management (4) (EE)	NA	NA	NA	NA	NA	NA	NA	
Credits	16	4								20
			Exit	option after 12	0 credits: UG degre	e				
VII	Bio Indicators and Eco Remediation (4) (EE) Medical Microbiology (4) (MB) Research Methodology & Ethics (4) (BI)	Nano Biotechnology (4) (BT) Genetic Engineering (4) (BT) NGS and R (4) (BI)	NA	NA	NA	NA	NA	NA	NA	
Credits	12	8								20
VIII	Biodiversity and Conservation (4) (EE)	NA	NA	NA	NA	NA	NA	NA	Project (12) (with	

	/								/	/
									research)	
									OR	
	Systems Biology								Drug Design,	
	(4) (BI)								Discovery &	
									Development	
									(4) (BI)	
									Microscopic	
									Techniques	
									(4) (BI)	
									Programming	
									Languages	
									for Biologists	
									(4) (BI)	
Credits	8								12	20
Total	76	32	9	12	9	8	4	2	12	164
Credits										

BIOLOGICAL SCIENCES

Course Code: LSXX Major 1

COURSE OBJECTIVES: This course introduces the basics and fundamental concepts of biology that covers the diversity of life, different kingdoms of living life, as well as applications of several fields in biology.

Unit I- Biodiversity and Classification

Classification of the living organisms -five kingdom classification concepts. Salient features of animals-non-chordates up to phylum level and chordates up to class level; salient features of plants -Angiosperms up to class.

Unit II- Structural arrangements of animal and plant systems

Anatomy and functions of animal organs- digestive, circulatory, respiratory, nervous, and reproductive. Anatomy and functions of dicots and monocots plants.

Unit III- Cell-Fundamental Unit of Life

Differentiate between plant and animal cell; cell envelope; cell membrane, cell wall. Cellular organelles - structure and function; endoplasmic reticulum, Golgiapparatus, lysosomes, vacuoles, mitochondria, ribosomes, plastids, microbodies; cvtoskeleton, cilia, flagella, centrioles; nucleus. Structure of DNA and Watson Crick model.

Unit IV- Human Diseases and Public Health Issues

Pathogens and parasites causing human diseases (dengue, chikungunya, dengue, filariasis, ascariasis, typhoid, pneumonia, common cold, amoebiasis, ring worm) and their control; cancer, diabetes, tuberculosis, anaemia, HIV and AIDS; Adolescence - drug and alcohol abuse.

Unit V- Biotechnological Applications

General perspectives of Biotechnology: Genetic engineering applications of biotechnology. Application of Biotechnology in health and agriculture: Production of Human insulin and vaccines.

Text Books

- 1. Sadava, David E., David M. Hillis, and H. Craig Heller. Life: The science of biology. Vol. 2. Macmillan, 2011.
- 2. Raven, Peter H., Ray F. Evert, and Susan E. Eichhorn. *Biology of plants*. Macmillan, 2005.
- 3. Cooper, Geoffrey M., and Robert E. Hausman. Cell. Vol. 5. Washington: ASM Press, 2009.
- 4. Stanier, R.V., Adelberg E.A and Ingraham J.L. General Microbiology. 5th edition. Macmillan Press, 2007.
- 5. Firdos Alam Khan. *Biotechnology Fundamentals*. 2nd edition. CRC Press, 2017.

COURSE OUTCOME: The students will be able to learn the basics biology, classification of the living organisms, nomenclature, and anatomy of different living systems. Also, they will be learned cell biology and application of biotechnology.

Credits: 4

15 h

10 h

10 h

12 h

FUNDAMENTALS OF NUTRITION

Course Code: LSXX Minor 1

COURSE OBJECTIVES: To gain knowledge about the major and minor nutrients, their classification, sources and deficiencies.

Unit I- Introduction to Nutrition

Nutrition- Introduction- Definition, history – concepts, scope. Energy - Definition and units, Calorific value of foods.BMR, BMI, RDA, Role of nutrition in maintaining health -Nutritional problems in India- malnutrition, obesity.

Unit II – Biomacromolecules

Carbohydrates - functions, source, utilization, Protein - Functions, sources and requirements, utilization, Protein quality – PER, BV, NPU, digestibility coefficient. Essential amino acids, Fats, and Lipids – Classification of Fatty acids, functions, sources, requirements, importance of essential fatty acids, their requirements, and deficiency. dietary fiber and health.

Unit III- Vitamins

Vitamins –-Classifications- functions, source, requirements, Dietary sources- deficiency disorders, Hypervitaminosis

Unit IV- Minerals and metabolism

Minerals – classification- macro and micro minerals, functions, absorption, synthesis, metabolism storage and excretion, deficiency, and toxicity

Unit V- Water and electrolytes

Water Balance –Functions of water, daily requirements, water distribution, maintenance of water and regulation of acid-base balance in the body, Electrolytes: Types, sources, composition of body fluids. Over hydration, dehydration, and water intoxication • Electrolyte imbalances

Text books

- 1. Fieldhouse, Paul. Food and nutrition: customs and culture. Springer, 2013.
- 2. Lanham-New, Susan A., et al., eds. *Introduction to human nutrition*. John Wiley & Sons, 2019.
- 3. Bender, David A. A dictionary of food and nutrition. OUP Oxford, 2009.

Suggested Readings

- 1. Vaclavik, Vickie A., Elizabeth W. Christian, and Tad Campbell. *Essentials of food science*. Vol. 42. New York: Springer, 2008.
- 2. Sienkiewicz, Frances, and Ellie Whitney Sizer. Nutrition: Concepts & Controversies. 2022.
- 3. Wilson, Eva D., Katherine H. Fisher, and Pilar A. Garcia. *Principles of nutrition*. No. Ed. 4. John Wiley and Sons., 1979.

Credits: 4

s.

12h

12 h

12 h

12 h

4. Williams, Sue Rodwell. *Basic nutrition and diet therapy*. No. Ed. 8. Mosby-Year Book, Inc., 1988.

COURSE OUTCOMES: After successful completion of this course, students will be able to understand the fundamental concepts of nutrition, functions and sources of the nutrients. Recognize the dual burden of malnutrition and modes of preventing them.

FUNDAMENTALS OF ECOLOGY

Course Code: LSXX Minor 1

COURSE OBJECTIVES: *The course is aimed*

1. To introduce students to the basic principles and terminology of ecology.

2. To explore the interactions between organisms and their biotic and abiotic environments.

3. To understand the dynamics of populations and communities in ecological systems.

4. To examine the structure and function of ecosystems and the flow of energy and nutrients within them.

5. To analyze the impacts of human activities on ecosystems and the importance of conservation and sustainability.

Unit I- Introduction to Ecology

Definition and scope of ecology, Historical development of ecological science, Levels of ecological organization, Ecological principles and concepts.

Unit II- The Environment and Organisms

Biotic and abiotic factors, Habitat vs. niche, Adaptations and evolutionary strategies, Ecological interactions: competition, predation, mutualism, and parasitism.

Unit III- Population Ecology

Population dynamics: growth, regulation, and factors influencing population size, Population distribution and dispersion patterns, Life history strategies and reproductive strategies, Population models: exponential and logistic growth.

Unit IV- Community Ecology

Community structure and diversity, Species interactions: competition, predation, herbivory, and symbiosis, Succession and ecological disturbance, Community stability and resilience.

Unit V- Ecosystem Ecology

Ecosystem structure and function, Energy flow and nutrient cycling, Trophic levels and food webs, Biogeochemical cycles: carbon, nitrogen, phosphorus, and water.

Unit VI- Human Impacts and Conservation

Human population growth and its ecological impacts, Habitat destruction and fragmentation, Biodiversity loss and species extinction - Conservation biology and sustainable practices.

Textbooks

- 1. Molles, MC and Sher, AA, 2015. Ecology: Concepts and Applications, 7th Edition, McGraw Hill Publication, ISBN: 13: 9781260722208.
- 2. Eugene P. Odum, 2017, Fundamentals of Ecology, 5th Edition, W.B. Saunders Co., Philadelphia, ISBN: 10: 8131500209

10h

10h

10h

10h

10h

10h

Credits: 4

Suggested reading

- 1. Robert E. Ricklefs and Rick Relyea, 2021. Ecology: The Economy of Nature, 9th Edition, Macmillan Learning, New York. ISBN: 10: 1319383815.
- 2. Oswald J. Schmitz, 2017. The New Ecology: Rethinking a Science for the Anthropocene, Princeton University Press; ISBN: 9780691160566

COURSE OUTCOME: Upon completion of this course students will

1. Understand the basic principles and concepts of ecology, including ecosystem structure, function, and dynamics.

2. Identify and describe the interactions between organisms and their environment at various scales, from individuals to ecosystems.

3. Evaluate the impact of human activities on ecological systems and biodiversity.

4. Apply ecological principles to address environmental challenges and propose sustainable solutions.

5. Develop a holistic understanding of global ecological patterns and processes, including biogeography, climate change, and conservation biology.

CLIMATE CHANGE AND SUSTAINABILITY

Course Code: LSXX Multidisciplinary 1

COURSE OBJECTIVE: To provide a comprehensive understanding of climate change and sustainability, emphasizing their interconnection and the multidimensional approaches required to address these challenges effectively. This course aims to foster critical thinking and problem-solving skills among students, enabling them to contribute constructively to climate change mitigation and sustainability efforts.

Unit I- Introduction to Climate Change and Sustainability

Basics of climate science and global environmental change, Principles of sustainability: Environmental, Economic, and social pillars, The interlinkages between climate change and sustainability.

Unit II- Impacts of Climate Change

Global and local impacts on ecosystems, biodiversity, and human societies, Climate-induced disasters: floods, droughts, and hurricanes, Case studies on regional climate change impacts in India.

Unit III- Sustainability Practices

Sustainable urban and rural development, Renewable energy sources and energy efficiency, Sustainable agriculture, water management, and waste management practices.

Unit IV- Climate Change Mitigation and Adaptation Strategies

Mitigation strategies: Reducing carbon footprints, afforestation, and green technology innovations, Adaptation measures: Building resilient infrastructure, community adaptation plans, and policy frameworks, The role of indigenous knowledge in adaptation and sustainability.

Unit V- Policy, Ethics, and Action

National and international policies on climate change and sustainability (e.g., Paris Agreement, SDGs), Ethical considerations in climate action and sustainability, Grassroots movements, civic engagement, and the role of individuals in promoting sustainability.

TextBooks

- 1. Climate Change and Environmental Sustainability (Advances in Science, Technology & Innovation) by Bao-Jie He, Deo Prasad, et al. 2023
- Climate Change Science: A Primer for Sustainable Development (Columbia University Earth 2. Institute Sustainability Primers) by Dr. John C. Mutter. 2020

COURSE OUTCOME: Upon completion, students will have a deep understanding of both climate change and sustainability issues, equipped with the analytical skills to evaluate environmental impacts and the practical knowledge to propose sustainable solutions within the framework of global and local policies.

9h

9h

Credits: 3

9h

9h

APPLICATION OF COMPUTERS IN BIOLOGY

Course Code: LSXX Skill 1

COURSE OBJECTIVES: To understand the basic knowledge on computer, & Internet terminologies and problem-solving techniques and browsing of biological databases and Websites.

Unit I- Introduction, Basic Applications of Computer

Components of Computer, Connecting Computer Components, Computer Hardware & Software, Basic concepts - Semiconductor RAM - ROM - Speed - Size and cost - Cache memories - Improving cache performance - Virtual memory - Memory management requirements - Associative memories -Secondary storage devices.

Unit II- Introduction to Databases and Transactions

Physical Database design, what is database system, purpose of database system, view of data, relational databases, the importance of data models, Database security, Introduction to SOL, Data Definition of SQL, Basic structure of SQL queries, Basic SQL operations. e.g. Biological databases

Unit III- Problem Solving Techniques

Algorithm & Flowchart for Biological problem, Overview of programming language Hierarchy -Development of source code in C language – Compilation and Execution of the problem – Refinement of source code by Testing and Debugging

Unit IV- Internet Technologies

Introduction to diverse Internet terminologies - Domain Name System - Function and Services of Internet Protocol Address, Web organizations and addressing, web browsers, web servers, Security and vulnerability, Web system Architecture-URL, Client side and server. e.g. Biological Web Portals

Unit V- Web technologies

Basics of HTML tags & skill of creating web pages, designing of webpage-Document Layout, Creating a Web Page and Web Site, Cloud Service Components - Deployment Models - Application of Cloud Computing. e.g. Biological Websites

Text Books

1. Dharmendra B. Kadia. Basic Knowledge of Computer. Shanti Prakashan 2010.

Suggested Readings

- 1. Internet Technologies Handbook:2023 Mark A Miller
- 2. Narasimha Karumanchi. 2023 Elements of Computer Networking. Career Monk publications.

COURSE OUTCOMES: On completion of this skill development course, students shall be able to aware and acquire the knowledge of the basic principles and concepts of computer science to browse and extract the information effectively from large databases. Problem-solving skills impart the knowledge of programming interface in biological application.

9h

6h

10h

Credits: 3

10h

BIOCHEMISTRY LABORATORY SKILLS

3 Credits

COURSE OBJECTIVES: The course aims to develop familiarity with biochemical laboratory techniques, and to introduce students to various practical aspects of laboratory and clinical investigations.

- 1. Good Laboratory Practices for a Biochemistry Lab.
- 2. Handling and calibration of micropipettes, weighing balance and pH meter.
- 3. Preparation of percentage, molar and normal solutions.
- 4. Preparation of buffer.
- 5. Preparation of stock and working solution.
- 6. Verification of Beers Lamberts law.
- 7. Separation of serum and plasma from goat/chick blood.
- 8. Determination of haemoglobin from goat/chick blood.
- 9. Determination of PCV.
- 10. Blood grouping.
- 11. Qualitative analysis of protein.
- 12. Qualitative analysis of amino acids.
- 13. Qualitative analysis of carbohydrates (mono, di and polysaccharide).
- 14. Qualitative analysis of lipids.
- 15. Qualitative analysis of nucleic acid (Bial's test).

*Both the Theoretical & Practical aspects will be covered

COURSE OUTCOME: The student will be able to apply the technical skill acquired in this course in research and clinical laboratories.

Text Books:

- 1) Boyer, Rodney F. *Biochemistry laboratory: modern theory and techniques*. Pearson education. Inc. 2012.
- 2) McKenzie, Shirlyn B. Clinical laboratory hematology. Pearson. 2004.
- 3) Plummer, D.T. An Introduction to Practical Biochemistry. Tata McGraw Hill. 2006.
- 4) J. Jayaram. *Laboratory Manual in Biochemistry*. New Age International Ltd. New Delhi. 1981.

Suggested Readings:

- 1. Praful B. Godkar. Textbook of Medical Laboratory Technology. Bhalani; 2021.
- 2. Kanai L. Mukherjee & Swarajit Ghosh. *Medical Laboratory Technology*. McGraw Hill Education; 2017.

- 3. Beedu Sashidhar Rao and Vijay Deshpande. *Experimental Biochemistry: A student Companion*. I.K. International Pvt. Ltd. 2005.
- 4. Dr. G. Rajagopal and Dr.B.D. Toora. *Practical Biochemistry: for medical, dental and allied courses*. Ahuja publishing house. 2005.
- 5. K.R. Aneja. *Laboratory manual of Microbiology and Biotechnology*. MEDTECH a division of Scientific international (Pvt. Ltd). 2018.
- 6. Segel, I.H. Biochemical Calculations. John Wiley & Sons. Inc. 1976.

BIOMOLECULES

Course Code: LSXX Major 2

COURSE OBJECTIVES To provide basic understanding of physical & chemical properties of macromolecules and principles of bioenergetics

UNIT I– Biomolecules concepts and Bioenergetics

General concepts of biomolecules, bonding and interactions. Bioenergetics: First and second laws of thermodynamics– entropy, enthalpy, standard free energy changes. Application of three laws in Life Science with examples. Role of electron transport chain in electron capture –ATP and high-energy phosphate compounds –Thermodynamics of coupled reaction.

UNIT II – Carbohydrates

Monosaccharides – stereochemistry, optical activity – Disaccharides – Oligosaccharides – N-linked, O-linked and GPI linked Oligosaccharides – Sugar derivatives. Homo- and hetero- polysaccharides. Glycoproteins – Proteoglycans – Glycosaminoglycans – structures and biological functions. Blood group substances and Sialic acid. Sugar code - Lectins types and functions. Biological functions of carbohydrates

UNIT III – Proteins and Amino acids

Amino acids classification and chemistry. Proteins– primary structure – secondary – tertiary - quaternary – super secondary structures. Sequence determination – Ramachandran plot. Globular and fibrous proteins (triple helix collagen and haemoglobin structure). Protein folding and dynamics– Molecular chaperones – heat shock proteins. Protein denaturation (pH, temperature, chaotropic agents) – refolding. Biological function of proteins

UNIT IV– Lipids

Lipids classification – structure and chemical properties – saturated and unsaturated fatty acids. Essential and non-essential fatty acids. Structure and functions of phospholipids – glycolipids – sphingolipids – lipid soluble vitamins. Lipoproteins types transport and functions. Biological functions of steroids and carotenoids.

UNIT V- Nucleic acids

Purine and Pyrimidines – structure and properties. Nucleosides. Nucleotides. DNA and RNA. Composition, structure, their biological importance, Nucleic acids types (A, B and Z forms), Comparison between DNA and RNA, Denaturation and Renaturation of nucleic acid, Tm, Hyper and hyperchromicity.

Text Books

1. Nelson, David L., Albert L. Lehninger, and Michael M. Cox. *Lehninger principles of Biochemistry*. Macmillan, 2012.

2. Voet, Donald, and Judith G. Voet. Biochemistry. John Wiley & Sons, 2010.

Suggested Reading

1. Garrett, R.H. and Grisham, C.M. (2016). Biochemistry, Cengage Learning, Mason. Ohio.

2. Berg, J.M., Tymoczko, J.L., Stryer, L. (2011) Biochemistry, W. H. Freeman, New York.

3. Harris, D.A. (1995) Bioenergetics at a glance. Willey J. and Sons Inc., New Jersey.

COURSE OUTCOME

The course will ensure basic understanding of physical, chemical and functional properties of macromolecules and basic principles of bioenergetics.

Credits: 3+1 p

9h

9h

10h

8h

BIOMOLECULES LAB

- 1. Qualitative analysis of carbohydrates: Molisch test and Iodine test
- 2. Test for reducing sugar: Fehling's test, Benedict's test, Barfoed's test, Seliwanoff's test, and Osazone test.
- 3. Estimation of starch by anthrone reagent
- 4. Qualitative analysis of amino acids: Ninhydrin test, Xanthoproteic test, Ehrlich's test, Hopkin's- Cole test and Sodium nitroprusside test
- Identification and Estimation of proteins: Biuret test, Bradford method, Sulphosalicylic acid test and Heat coagulation test
- 6. Qualitative tests for lipids: Solubility and Saponification test,
 - a. Tests for unsaturation: Bromine water test
 - b. Test for cholesterol: Salkowski test.
- 7. Determination of purity of nucleic acid (DNA) by UV-absorption method
- 8. Estimation of Vitamin-C (Ascorbic acid)

Textbooks

Walker, John M., and Keith Wilson, eds. *Principles and Techniques of biochemistry and molecular biology*. Cambridge university press, 2010.

GENETICS

Course Code: LSXX Minor 2

COURSE OBJECTIVES: This course explains the mechanism of inheritance of traits from one generation to the next. It begins with the Mendelian concepts and the emergence of the science of genetics. It also demonstrates how the principles of genetics can be used to unravel the molecular function of genes and study human diseases.

Unit I- Introduction

History of genetics, its scope and significance, brief idea of Mendel's laws and physical basis of heredity (chromosome theory of inheritance), Inheritance of acquired characters and Mutation theory. Heredity and Environment: Concepts of Phenotype, Genotype, Heredity, variation, Pure lines and Inbred lines.

Unit II- Biography of Mendel and his experiments on pea plants

Law of Segregation: Monohybrid cross, Back cross and Test cross. Law of Independent Assortment: Dihybrid cross in pea plant, Back cross and Test cross with examples and Problems related. Extra chromosomal inheritance: brief idea of mitochondrial and chloroplast genetics, paternal inheritance.

Unit III- Multiple alleles

Concept of multiple alleles; Deviations from Mendelism: Incomplete inheritance and Codominance, self-incompatibility alleles in plants; coat colour in rodents; blood groups in humans, antigen-antibody interaction in the inheritance of A, B, AB and O blood groups; H – antigens, MNS system, Rh factor. Epistasis and multiple allelism (e. g. Bombay blood groups).

Unit IV- Sex Determination

Chromosome theory of Sex determination: XX- XY, XX-XO, ZZ-ZW, Genic balance theory of Bridges. Environment and sex determination, Gynandromorphs Genetics. Dosage compensation in Drosophila, and Man (Lyon's hypothesis). Sex differentiation in Drosophila and Man. human sex anomalies (Klinefelter's syndrome and Turner's syndrome). Sex-linked inheritance: X-linked dominance, X-linked recessive and Y-linked inheritance.Pedigree analysis.

Unit V- Mutations and mutagenic agents

Brief history of genetic mutation; types of mutations; rate and frequencies of mutations; physical and chemical mutagens and deletogens; detection of mutations in Drosophila, detection of mutations in plants and their practical application in crop improvement. Biochemical genetics: Inborn errors of metabolism in man; Inherited and acquired gene mutation in human cancer.

Text Books

1. Griffiths AJF, Doebley J, Peichel C and Wassarman D. *Introduction to genetic analysis*. New York: W.H. Freeman & Co. 2020.

2. Snustad, D. Peter, and Michael J. Simmons. Principles of genetics. John Wiley & Sons. 1998.

Suggested Reading

1. Pierce BA, Genetics: a conceptual approach. New York: W.H. Freeman & Co. 2020.

COURSE OUTCOME: Upon successful completion of the course, students can: understand basic genetic principles based on Mendelian inheritance. Demonstrate working knowledge in multiple

Credits: 4

11h .

12h

11h

12h

allilism and pedigree analysis and comprehend genetic mutation and the mechanisms of various genetic diseases.

NUTRACEUTICALS AND FUNCTIONAL FOODS

Course Code: LSXX Minor 2

COURSE OBJECTIVES: To develop comprehensive understanding of different nutraceuticals and functional foods and to understand the potential of various functional foods in promoting human health

Unit I- Introduction to Nutraceuticals and Functional Foods

Definition, concept, history, and market. Classification of nutraceuticals and functional foods. Evolution of nutraceuticals and functional foods market. Significance and relevance of nutraceuticals and functional foods in the management of diseases and disorders.

Unit II- Nutraceuticals

Types of nutraceutical compounds – Phytochemicals, phytosterols and other bioactive compounds, peptides and proteins, carbohydrates (dietary fibers, oligosaccharides and resistant starch lipids (Conjugated Linoleic Acid, omega-3 fatty acids, fat replacers), vitamins and minerals; their sources and role in promoting human health

Unit III- Functional Foods

Cereal and cereal products, Milk and milk products, egg, oils, meat and products, sea foods, nuts and oilseeds, functional fruits and vegetables, herbs and spices, beverages (tea, wine etc.), Fermented foods – their health benefits and role in conditions like cardiovascular diseases, hypertension, diabetes etc. Future prospects of functional foods and nutraceuticals and their potential for use in improving health. Development in processing of functional foods.

Unit IV- Prebiotics, probiotics and symbiotics

Definition, types and relevance; Usefulness in gastro intestinal health and other health benefits. Challenges and regulatory issues

Unit V- Safety and Legal Aspects

Stability of nutraceuticals. Safety, Consumer acceptance and assessment of health claims, labeling, marketing and regulatory issues related to nutraceuticals and functional foods.

Text Books

- 1. Anjana Agarwal, Shobha A Udipi. Text Book of Human Nutrition. Jaypee Brothers Medical Publishers. 2013
- 2. B. Srilakshmi. Food Science. New Age International Publishers. 2018
- 3. Sharma, Al. Textbook of Human Nutrition. Medical Journal, Armed Forces India
- 4. PV Suryaprakash Rao Orientation for Food Professionals a hand book. Panganamamula foundation. 2005

12 h

12 h

Credits: 4

12 h

12 h

Suggested Readings

- 1. Hand book of Nutraceuticals and functional foods, second editin.CRC press- Wilman REC.
- 2. Functional Foods Concept to Product (2000) Gibson GR and Williams CM.
- 3. Functional Foods: Designer Foods, Phrama Foods (2004) Goldberg I.
- 4. Dietary supplements: Toxicology and clinical Pharmacology Cuppj and Tracy TS, Humana

COURSE OUTCOMES: Enumerate the many categories of functional foods that offer health advantages. Exhibit expertise in the scientific foundation and existing technology to propose prospective novel functional food products

CONCEPTS IN PROGRAMMING LANGUAGES

Course Code: LSXX Multidisciplinary 1

COURSE OBJECTIVES: To introduce the computer programming concepts to students. This course suits for students with non-computer background.

Unit I-Basics of Computing principles

Concepts of Input and Output – Input devices – Output devices – Number systems – Binary, Octal, and hexadecimal systems – Boolean algebra (AND, OR, NOT and EXOR operations) – DeMorgan's theorem.

Unit II-Operating Systems

Concept of operating system – DOS, UNIX and LINUX – Types of processing – multiprogramming, multitasking, and multithread processing.

Unit III-Problem Solving Techniques

Basics of problem-solving techniques – Understanding the problem – Algorithm – Flowchart – coding.

Unit IV-Classification of computer languages:

Human and computer languages – Machine level language – Assembly level language – High level language – Assembler and compiler – compilation – basic principles of coding – Testing of a program – debugging – syntax and semantic errors.

Unit V-Concepts in computer programming:

Role of decision making – illustration of 'if' – Concept of loops – importance of loops in programming – arrays and stacks – file handling – interface with internet.

TextBooks

1. Reema Thareja. Fundamentals of Computers. Oxford University Press. 2019.

Suggested reading

1. Silberschatz, Abraham, Peter B. Galvin, and Greg Gagne. *Operating system concepts essentials*. Wiley Publishing, 2018.

<u>COURSE OUTCOME</u>: The students will possess basic knowledge about programming languages. On successful completion of the course, the student will be able to self-learn most of the programming languages.

8 h

11 h

8 h

9 h

Credits: 3

MOLECULAR DIAGNOSTICS

Course Code: LSXX Skill 2

COURSE OBJECTIVE: The objective of the course is to make Students aware of the various medical diagnostic techniques and their use in diagnosing various disorders in humans.

Unit I Immunoassays

Comparison of enzymes available for enzyme immunoassays, conjugation of enzymes. Solid phases used in enzyme immunoassays. Homogeneous and heterogeneous enzyme immune assays. Enzyme immune histochemical techniques. Use of polyclonal or monoclonal antibodies in enzymes immune assays.

Unit II Genetics and diagnostics

General features of Chromosomes, chromosome banding patters, karyotyping, DNA profiling hybridization arrays. Early detection of diseases.

Unit III Molecular methods

Nucleic acid extraction: principles and methods. Assessing purity and concentration of nucleic acids, PCR-basic and applied-Alu-PCR, PCR-ELISA, Single nucleotide polymorphisms (SNP), plasmid fingerprinting in infections, Detection of mutation using ARMS-PCR and microsatellite markers.

Unit IV

Allele susceptibility test for multifactorial disorders, Micro-dilution and broth procedures, Diffusion test procedure, Automated procedures for antimicrobial susceptibility tests.

Unit V

HPLC, GLC, PFGE, DGGE. Electron microscopy, flow cytometry, and cell sorting, Use of nucleic acid probes and antibodies in clinical diagnosis, and tissue typing.

Practicals

- 1. Kirby-Bauyer method (disc-diffusion method) to study antibiotic sensitivity of a bacterial Culture
- 2. Kit-based detection of a microbial infection (Widal test)
- 3. Enumeration of RBC and WBC using haemocytometer
- 4. Blood platelet count by hemocytometer
- 5. Detection of abnormal constituents in urine
- 6. Clinical estimation of glucose, and cholesterol by kits
- 7. Demonstration of Electrocardiogram or ECG
- 8. Perform any immune diagnostic test (Diabetes, Typhoid, Malaria, Dengue, etc.)
- 9. Physiological Measurements: Blood Pressure (normal & under stress) and Temperature.

9h

9h

9h

9h

Suggested Reading

- 1. Fundamentals of Molecular Diagnostics by David E. Bruns, W.B. Saunders Company.
- 2. Practical Biochemistry, Principles and Techniques, Keith Wilson and John Walker Bioinstrumentation, Webster
- 3. Advanced Instrumentation, Data Interpretation, and Control of Biotechnological Processes, J.F. Van Impe, Kluwer Academic
- 4. Brooks GF, Carroll KC, Butel JS, and Morse SA. (2007). Jawetz, Melnick and Adelberg's Medical Microbiology. 24th edition. McGraw Hill Publication.
- 5. Molecular Diagnostics: Fundamentals, Methods and Clinical Applications by Lela
- 6. Buckingham. Microscopic Techniques in Biotechnology, Michael Hoppert
- 7. Wilson, K. and Walker, J. Practical Biochemistry Principles and techniques 7th edition, 2010, Cambridge University Press,
- 8. Primrose Sandy B. and Richard Twyman, Principles of Gene Manipulation and Genomics (7th Edition), Wiley-Blackwell 2006.
- 9. Brown T. A, Gene Cloning and DNA Analysis: An Introduction, (6th Edition) Wiley Blackwell, 2010.
- 10. Terence A. Brown, Genomes 2, (3rd edition)- Garland Science Publishing.

COURSE OUTCOMES: The students will be able to receive insights about genetic diseases and its detection. Gain new insights into medical genetics and prenatal diagnosis. Gain knowledge about different diagnostic procedures.

EXTRUDED SNACKS TECHNOLOGY

Course Code: LSXX Skill 2

COURSE OBJECTIVES: To understand the fundamentals of extrusion technology in snack production and identify different types of extruded snacks and their ingredients. To analyze the influence of processing parameters on snack properties and to develop skills in flavoring, seasoning, and product development and to implement quality control measures to ensure product consistency. Evaluate market trends and consumer preferences in the snack industry.

Unit I- Introduction to Extruded Snacks

Overview of the snack industry, types of extruded snacks, market analysis and consumer trends. Ingredients and Formulations, selection of raw materials (grains, starches, pulses), Functional ingredients (proteins, fibers, fats), Formulation development and optimization.

Unit II- Extrusion Principles and Equipments

Basics of extrusion technology, single-screw and twin-screw extruders, process parameters and their effects on snack properties. Extrusion Equipment: Components of an extrusion system, Operation and maintenance of extruders, Auxiliary equipment (preconditioners, cutters, dryers)

Unit III- Flavoring and Seasoning and Quality Control

Types of flavors and seasonings and its application methods (spraying, tumbling), flavor optimization and sensory evaluation. Quality Control: Quality attributes of extruded snacks, Testing methods (texture analysis, moisture content), Process monitoring and troubleshooting.

Unit IV- Product Development, Packaging and Shelf Life

New product ideation and concept development, Prototype formulation and testing, Scale-up and commercialization considerations. Packaging and Shelf Life: Packaging materials and formats, Shelf life testing and evaluation, Packaging regulations and labeling requirements

Unit V- Marketing and Consumer Insights

Branding and product positioning, Consumer preferences and behavior, Market research techniques

Practicals

- 1. Determination of starch content in cereal flour
- 2. Determination of degree of gelatinization in cereal extrudates.
- 3. Effect of fiber rich ingredient on extrudate food product characteristics
- 4. Introduction of food extruders components and their functions
- 5. Effect of extruder screw speed and barrel temperature on extrudate food product characteristics
- 6. Texture profile analysis of extruded product
- 7. Effect of feed moisture content on extrudate food product characteristic
- 8. Effect of fat addition on extrudate product characterisites
- 9. Determination of quality parameters (storage, moisture) for prepared extruded snack product.
- 10. Studies on development of pasta, chips, puffs by extrusion technology (sensory analysis, keeping quality, shelf life)

Credits: 3

9h

9h

9h

9h

Text Books

- 1. D.R. Gray, R. Chinnaswamy. *Role of extrusion in food processing by in Food Processing: Recent Developments*. Anilkumar Gaonkar Publisher Elsevier.
- 2. Vivian Offiah, vassilis kontogiorgos and Kolawole O. Falade. *Extrusion processing of raw food.* 2019.

Suggested Readings

- 1. Panda H. The Complete Technology Book on Snack Foods. NIIR Project Consultancy Services, 2013.
- 2. Edmund W. Lusas, Lloyd W. Rooney. Snack Foods Processing. CRC Press. 2001.
- 3. Frame ND. The Technology of Extrusion Cooking. Blackie Academic. 1994.
- 4. Gordon BR. Snack Food Technology. AVI Publication. 1997.
- 5. Samuel AM. Snack Food Technology. AVI Publication. 1964.

COURSE OUTCOME: This course provides an in-depth understanding of the production processes involved in manufacturing extruded snacks. Topics covered include raw materials selection, extrusion principles, equipment operation, flavoring and seasoning, quality control, and market analysis.