CHHATRAPATI SHAHU JI MAHARAJ UNIVERSITY

KANPUR

Three-Year Undergraduate Programme

Syllabus of

B.Sc. (HONOURS) BIOLOGICAL SCIENCE

THREE-YEAR B.Sc. (HONOURS)

IN BIOLOGICAL SCIENCE

SESSION 2025-2026

ONWARDS

Prof. Neelam Pathak (ONLINE)
Prof. Ram Narain (ONLINE)
Prof. B.N. Mishra (ONLINE).

CHHATRAPATI SHAHU JI MAHARAJ UNIVERSITY, KANPUR
STRUCTURE OF SYLLABUS FOR THE
Program: B.Sc. (Honours) Biotechnology

Syllabus Developed By			
Name of BoS convenor/BoS member	**Designation**	**Department**	**College/University**
Prof. S. K. Awasthi	Dean, Faculty of Life Sciences	Department of Life Sciences, School of Life Sciences and Biotechnology	CSJM University, Kanpur
Prof. Varsha Gupta	Director, School of Life Sciences and Biotechnology	Department of Life Sciences, School of Life Sciences and Biotechnology	CSJM University, Kanpur
Prof. Neelam Pathak	External Expert	Department of Biochemistry	R.M.L. Awadh University, Ayodhya
Prof. Ram Naraian	External Expert	Department of Biotechnology	V.B.S. Purvanchal University, Jaunpur
Prof. B. N. Mishra	External Expert	Department of Biotechnology	Instt. Of Engineering and Technology, Lucknow
Prof. Rolee Sharma	Professor	Department of Life Sciences, School of Life Sciences and Biotechnology	CSJM University, Kanpur
Dr. Shilpa D. Kaistha	Associate Professor	Department of Biotechnology, School of Life Sciences and Biotechnology	CSJM University, Kanpur
Dr. Alok Pandey	Assistant Director, School of Life Sciences and Biotechnology	Department of Biotechnology, School of Life Sciences and Biotechnology	CSJM University, Kanpur
Dr. Neerja Srivastava	Coordinator, Biochemistry and Biological Science programs	Department of Biochemistry, School of Life Sciences and Biotechnology	CSJM University, Kanpur

CHHATRAPATI SHAHU JI MAHARAJ UNIVERSITY, KANPUR

Programme: B.Sc. (Honours) Biological Science

Course Structure

Semester – I			
Code	**Paper**	**Courses**	**Credits**
BH260101T	Core Course - I	General Biochemistry	4
BH260102T	Core Course -II	Cell Biology	4
BH260103P	Practical -I	Practical	4
VOCxxx	Skill Enhancement course (SEC)	Vocational Skill Enhancement course (As per Univ. Guidelines)	3
Z011101	Co-curricular Course	First Aid and Basic Health	2
		Total credits	17

Semester – II			
Code	**Paper**	**Courses**	**Credit**
BH260201T	Core Course - I	Plant Physiology	4
BH260202T	Core Course -II	Mammalian Physiology	4
BH260203P	Practical -II	Practical	4
BH100204M	Minor Course	IPR Entrepreneurship Bioethics & Biosafety (From Dept of Biotechnology)	6
VOCxxx	Skill Enhancement course (SEC)	Vocational Skill Enhancement course (As per Univ. Guidelines)	3
Z021201	Co-curricular Course	Human Values and Environment Studies	2
		Total Credits	23

Note:

1. Total Credits 40 till semester II
2. Student is entitled for certificate in Faculty after successful completion of first two semesters

Semester - III			
Code	**Paper**	**Courses**	**Credits**
BH260301T	Core Course - I	Microbiology	4
BH260302T	Core Course -II	Fundamental of Genetics	4
BH260303P	Practical -III	Practical	4
VOCxxx	Skill Enhancement course (SEC)	Vocational Skill Enhancement course (As per Univ. Guidelines)	3
Z031301	Co-curricular Course	Physical Education and Yoga	2
		Total credits	17

Semester - IV			
Code	**Paper**	**Courses**	**Credit**
BH260401T	Core Course - I	Intermediary Metabolism	4
BH260402T	Core Course -II	Biophysical Chemistry and Techniques	4
BH260403P	Practical -IV	Practical	4
BH100404M	Minor Course	Medical Biotechnology (From Dept of Biotechnology)	6
BH260405R	Project	Research Project/Internship/Field Work	3
Z041401/ Z041402	Co-curricular Course	Social Responsibility and Community Engagement/Indian Language	2
		Total Credits	23

Note:

1. Total Credits 80 till semester IV
2. Student is entitled for Diploma in Faculty after successful completion of four semesters

Semester -V			
Code	**Paper**	**Courses**	**Credits**
BH260501T	Core Course – I	Molecular Biology	4
BH260502T	Core Course –II	Immunology	4
BH260503T	Core Course – III	Enzymology	4
BH260504T	Core Course –IV	Biostatistics	4
BH260505P	Practical – V	Practical	4
BH260506R	Research Project	Research Project on topics which are Inter/Intra faculty	5
		Total credits	25

Semester - VI			
Code	**Paper**	**Courses**	**Credit**
BH260601T	Core Course - I	Principles of Genetic Engineering	4
BH260602T	Core Course -II	Environmental Biology	4
BH260603T	Core Course – III	Fermentation Technology	4
BH260604T	Core Course -IV	Bioinformatics	4
BH260605P	Practical - VI	Practical	4
BH260606R	Research Project	Research Project on topics which are Inter/Intra faculty	5
		Total Credits	25

Note:

1. **Total Credits 130 till semester VI**
2. **Student is entitled for Three Year B.Sc. (Honours) Biological Science UG Degree after successfully completion of six semesters.**

Program Outcomes (POs)

PO1: In this course, students will learn how to apply sound theoretical, experimental knowledge to jobs in health and bioprocess technology, food technology, nanotechnology, environmental biotechnology and related multidisciplinary areas.

PO2: The program will enhance the subject knowledge of students by using traditional and modern ICT based teaching methods and learning by doing.

PO3: Identify and critically analyse relevant problems in biological sciences, and scientific discipline using appropriate tools and techniques as well as explore and work on approaches to address conclusions/solutions.

PO4: To enrich students' knowledge and train them in various branches of Biological Sciences such as genetics, molecular biology, biochemistry, immunology, fermentation technology, environmental biotechnology and tissue culture techniques.

PO5: To develop the zeal and ability to work safely and effectively in a laboratory. Acquire knowledge in technical and scientific areas to identify research problems, design experiments, use appropriate methodologies, analyse and infer the data and explore the solutions. The program will also enhance the ability of organizational skills and management of time and resources.

PO6: The program will enhance the skills to effectively accomplish tasks independently and as a team member in multidisciplinary areas of research and development.

PO7: Through B.Sc. Biological Sciences program, students will learn how to write dissertations, reports, make effective presentations, and document their findings. In addition to that, the program will teach students how to communicate effectively with both scientists and the general public.

PO8: Program has a very important part to learn and develop professional ethics and responsibility and serve the society.

Programme Specific Outcome

At the end of the programme, the student will be able to

PSO1: To provide students with all the research skills they need to work independently.

PSO2: To develop scientific temperament and social responsibilities in the students.

PSO3: To impart knowledge of advanced modern techniques.

PSO4: To empower the students to acquire technical knowledge by connecting disciplinary and interdisciplinary aspects of Biological Sciences.

PSO5: Provide students with knowledge that will enable them to apply their knowledge in industry and research.

PSO6: Development of scientific outlook not only with respect to science subjects but also in all aspects related to life

Course Outcomes of Each of the course

SEM I

BH260101T (Core Course -I): General Biochemistry

Course Outcome (CO)	Description
CO-1	The course will facilitate learning on chemical and molecular foundations of life and the role of energy rich compound in biological systems.
CO-2	The course offers enhanced learning of structure, classification, role and function of macromolecules for example, sugar and polysaccharides, amino acids and proteins, lipids and nucleic acids
CO-3	The course provides enhanced understanding of signaling molecules and pathways.
CO-4	The course provides advance learning on different vitamins, coenzymes and their metabolism

BH260102T (Core Course – II): Cell Biology

Course Outcome (CO)	Description
CO-1	This course introduces the students to the basics of cell and its components.
CO-2	This gives them a strong foundation on the basic unit of life.
CO-3	Through the course, student builds a strong foundation on the functions of the cell.
CO-4	Students will understand the structures and purposes of basic components of prokaryotic and eukaryotic cells, especially macromolecules, membranes, and organelles
CO-5	Students will understand how these cellular components are used to generate and utilize energy in cells

BH260103P: Practical I

VOCxxx: {Skill Enhancement course (SEC)}: Vocational Skill Enhancement course

Z011101 (Co-curricular Course): First Aid and Basic Health

SEM II

BH260201T: (Core Course-I): Plant Physiology

Course Outcome (CO)	Description
CO-1	This course aims to educate student about the mechanism and physiology life processes in plants
CO-2	The course also focuses on the plant nutrient uptake and translocation, photosynthesis, respiration and nitrogen metabolism. and are able to coordinate the various processes.
CO-3	This course aims at making the students acquainted with the fundamentals and present understanding of the mechanisms associated with development, differentiation and structure of various plant organs, the metabolic and physiological changes occurring in them.
CO-4	The course also covers the studies on plant growth and development.

BH260202T: (Core Course – II): Mammalian Physiology

Course Outcome (CO)	Description
CO-1	The course will cover fundamental mechanisms that operate in a living organism and how they interact.
CO-2	In this course, students will examine basic concepts of mammalian physiology, including membrane biology, protein structure as applied to the structure of trans-membrane transport proteins, cellular excitability and neuronal signalling.
CO-3	The course will also cover mechanisms of muscle physiology, sensory-motor integration, blood and fluid mechanics, cardiovascular physiology and regulation, gas transport and control of respiration, digestive system function, renal physiology and electrolyte homeostasis, endocrine function, growth and metabolism.
CO-4	The course will also cover how body maintains conditions within a narrow range of values in the presence of a continually changing environment.

BH260203P: Practical -II

Minor Course: BH100204M IPR Entrepreneurship Bioethics & Biosafety

VOCxxx: {Skill Enhancement course (SEC)} Vocational Skill Enhancement course

Z021201: Co-curricular Course): Human Values and Environment Studies

SEM III

BH260301T: (Core Course – I): Microbiology

Course Outcome (CO)	Description
CO-1	This fundamental paper discusses the importance of microorganisms.
CO-2	The course throws light on types of microorganisms in and around humans
CO-3	The student will learn the metabolism and mechanism of microbial life
CO-4	The course demonstrates the contribution of the microbiologists and the microbiology laboratory to the diagnosis of infection including specimen collection.
CO-5	To illustrate the characteristic features of microorganisms and the disease they cause. The course also facilitates learning of different methods to control microorganism growth.

BH260302T (Core Course -II): Fundamental of Genetics

Course Outcome (CO)	Description
CO-1	Through this course, students will gain a basic understanding on human genetics and hereditary. The student will learn Mendelian genetics and deviations from Mendelian analysis.
CO-2	Discussing the progression of discovery from Classical to Modern Genetics.
CO-3	The student will demonstrate knowledge of the mechanisms of genetic change through DNA mutation and repair, methods to detect mutation, variations in chromosome number and structure to phenotypic variations.
CO-4	Relating the chromosomal basis of inheritance, comparing contrasting genes, chromosomes, genome and describing gene linkage.

BH260303P: Practical -III

VOCxxx: {Skill Enhancement course (SEC)}: Vocational Skill Enhancement course

Z031301: (Co-curricular Course): Physical Education and Yoga

SEM IV

BH260401T: (Core Course – I): Intermediary Metabolism

Course Outcome (CO)	Description
CO-1	Intermediary metabolism is the subfield of biological sciences that covers highly integrated network of biochemical reactions that provides cells with forms of energy for immediate use (i.e., metabolic energy), reducing power and biosynthetic intermediates.
CO-2	The course explains the role of catabolic and anabolic pathways in cellular metabolism.
CO-3	Distinguish between exergonic and endergonic reactions in terms of available energy change.
CO-4	Describe the structure of ATP and identify the major class of macromolecules to which ATP belongs.

BH260402T: (Core Course -II): Biophysical Chemistry and Techniques

Course Outcome (CO)	Description
CO-1	Students learn about various analytical techniques that are routinely used for separation of biomolecules and their components.
CO-2	The objective of this course is to familiarize students with the basic concepts and applications of modern techniques used in Biochemistry, Biophysics, Cell and Molecular Biology.
CO-3	To learn the application of different techniques and tools in different areas of scientific research.
CO-4	The students will be able to understand the principle and working of different chromatography techniques.
CO-5	To understand the principle and working of different centrifugation techniques.
CO-6	The students will grasp deep understand on the principle and working of different electrophoretic and molecular biology techniques.

BH260403P: Practical -IV

Minor Course: BH100404M Medical Biotechnology

BH260405R: Project: Research Project/Internship/Field Work

Z041401/Z041402: (Co-curricular Course): Social Responsibility and Community Engagement/Indian Language

SEM V

BH260501T: (Core Course – I): Molecular Biology

Course Outcome (CO)	Description
CO-1	This course introduces students to molecular biology, which involves interactions between various systems of the cell, including those between DNA, RNA, and proteins.
CO-2	It deals with understanding the molecular aspects of the biology.
CO-3	To gain an understanding of biochemical and molecular processes that occurs in and between cells.
CO-4	To learn and acquire knowledge on tools and techniques related to molecular biology.
CO-5	To develop ability to design and implement experimental procedures using relevant techniques.

BH260502T: (Core Course -II): Immunology

Course Outcome (CO)	Description
CO-1	It trains the students with essentiality of molecules, cells, tissues, and organs involved in the defence mechanism.
CO-2	The course provides information and understanding of immunology and its application to diagnostics.
CO-3	An important aspect of this course is the learning of techniques used in understanding immunological aspects of both physiology and biological samples.
CO-4	As a result of this course, students will be able to describe how the immune system maintains health as well as contributes to disease. Furthermore, students will be able to identify the cellular and molecular basis of immune response and vaccine biology.
CO-5	The students will be able to describe immunological response and how it is triggered and regulated.
CO-6	The students will be able to transfer knowledge of immunology into clinical decision- making through case studies presented in class.

BH260503T: (Core Course – III): Enzymology

Course Outcome (CO)	Description
CO-1	To learn about general properties of enzymes like activation energy, active site, etc.; definition of enzyme activity and its various units; classes of enzymes and international nomenclature, the types of enzyme assays; and the various kinds of techniques employed for purification.
CO-2	It helps the students to learn the methodology involved in assessing the enzyme activity and mechanism of enzyme action.
CO-3	It illustrates the enzyme catalysis, kinetics and regulatory aspects.
CO-4	It helps the students to learn the significant features of the biochemical catalysts.
CO-5	Describes multienzyme complexes and isozymes.

BH260504T: (Core Course -IV): Biostatistics

Course Outcome (CO)	Description
CO-1	This course imparts the knowledge of basic statistical methods to solve problems.
CO-2	Students will learn to operate various statistical software.
CO-3	The students will be better prepared for careers in research by understanding the importance of statistics in research.
CO-4	To construct knowledge about the various applications of software and statistics to the students.
CO-5	Solve mathematical and statistical problems individually and with fellow classmates.

BH260505P: Practical – V

BH260506R: (Research Project): Research Project on topics which are Inter/Intra faculty

SEM VI

BH260601T: (Core Course – I): Principles of Genetic Engineering

Course Outcome (CO)	Description
CO-1	This core-course introduces students to versatile tools and techniques used in genetic engineering.
CO-2	This course provides theoretical bases to properties and applications of versatile DNA modifying enzymes, cloning strategies, vector types, host genotype specificities for selection and screening of recombinants and/or recombinant transformants.
CO-3	Introduction to various types of vectors viz. cloning, transformation, expression; and also vectors for genomic and cDNA library and whole genome sequencing will be provided
CO-4	A critical appraisal of methods for site-directed mutagenesis and sequencing of cloned genomic fragments will also be covered.
CO-5	The students will be familiarized to software permitting in-silico manipulation and annotation of DNA sequences for efficient design, tracking, and management of cloning experiments in the laboratory.

BH260602T: (Core Course -II): Environmental Biology

Course Outcome (CO)	Description
CO-1	The students in the course are exposed to the diversity, function, ecological adaptation of microorganisms within the environment.
CO-2	This course gives the importance of microbial life to key ecosystem process and teaches the role of biotechnology to address environmental issues.
CO-3	The course will acquaint the students with the various environmental hazards like environmental pollution, greenhouse effect and ozone layer depletion.
CO-4	Development of understanding on ecology and environmental biology
CO-5	Appreciate the inter-relationship between organism in population and communities.
CO-6	Understand principles of toxicology and the harmful effects of toxic metals on humans and environment.

BH260603T: (Core Course – III): Fermentation Technology

Course Outcome (CO)	Description
CO-1	This course will help students to acquire basic knowledge of fermentation process and industrial application of microbes for the production of useful products.
CO-2	Students will learn sterilization of air and medium; sterilization of fermenter, thermal death kinetics of microorganisms.
CO-3	The course aims to provide fundamental insights to exploit microbes for manufacturing of products which have huge industrial significance.
CO-4	The course blends science and engineering with various biochemical processes to obtain products such as food, chemicals, vaccines, and medicine.
CO-5	The student will have a better appreciation for the role of microbes in industry using technology.

BH260604T: (Core Course -IV): Bioinformatics

Course Outcome (CO)	Description
CO-1	It provides an introduction to selected important topics in biostatistical concepts and reasoning.
CO-2	This course represents an introduction to the field of data and data types.
CO-3	The students learn specific topics including tools for describing central tendency and variability in data; statistical hypothesis testing and its application to group comparisons; issues of power and sample size in study designs; and random sample and other study types.
CO-4	To understand the alignment between two sequences.
CO-5	To demonstrate the role of bioinformatics in genomics and proteomics

BH260605P: Practical - VI

BH260606R: (Research Project): Research Project on topics which are Inter/Intra faculty

Syllabus for B.Sc. (Hons) Biological Science

SEM I

BH260101T (Core Course – I): Cell Biology

UNIT I- Cell: Introduction and classification of organisms by cell structure, cytosol, compartmentalization of eukaryotic cells, cell fractionation. Cell Membrane and Permeability: Chemical components of biological membranes, organization and Fluid Mosaic Model, membrane as a dynamic entity, cell recognition and membrane transport. Introduction to IKS.

UNIT II- Membrane Vacuolar system, cytoskeleton and cell motility: Structure and function of microtubules, · Microfilaments, Intermediate filaments. Endoplasmic reticulum: Structure, function including role in protein segregation. Golgi complex: Structure, biogenesis and functions including role in protein secretion.

UNIT Ill - Lysosomes: Vacuoles and micro bodies: Structure and functions Ribosomes: Structures and function including role in protein synthesis. Mitochondria: Structure and function, Genomes, biogenesis. Chloroplasts: Structure and function, genomes, biogenesis Nucleus: Structure and function, chromosomes and their structure

UNIT IV - Extracellular Matrix: Composition, molecules that mediate cell adhesion, membrane receptors for extra cellular matrix, macromolecules, regulation of receptor expression and function. Signal transduction. Cancer: Carcinogenesis, agents promoting carcinogenesis, characteristics and molecular basis of cancer.

Suggested reading:

Karp, G. 2010. Cell and Molecular Biology: Concepts and Experiments. 6th Edition. John Wiley & Sons. Inc.

De Robertis, E.D.P. and DeRobertis, E.M.F. 2006. Cell and Molecular Biology. 8th edition. Lippincott Williams and Wilkins, Philadelphia

Cooper, G.M. and Hausman, R.E. 2009. The Cell: A Molecular Approach. 5th edition. ASM Press & Sunderland, Washington, D.C.; Sinauer Associates, MA.

Becker, W.M., Kleinsmith, L.J., Hardin. J. and Bertoni, G. P. 2009. The World of the Cell. 7th edition. Pearson Benjamin Cummings Publishing, San Francisco.

https://egyankosh.ac.in/handle/123456789/78161

BH260102T (Core Course -II): General Biochemistry

Unit I- Biomolecules in their cellular environment: The cellular basis of life. Cellular structures – prokaryotes and eukaryotes. Chemical principles in biomolecular structure. Major classes of biomolecules. Role of water in design of biomolecules. Biochemistry through IKS

Unit II- Amino acids and peptides: Types of amino acids and their chemistry, derivatives of amino acids and their biological role. Introduction to biologically important peptides

Unit III Sugars and polysaccharides: Basic chemistry of sugars, optical activity. Disaccharides, trisaccharides and polysaccharides - their distribution and biological role. Lipids: Various classes of lipids and their distribution, storage lipids, structural lipids in membranes, lipids as signals, cofactors and pigments

Unit IV Nucleosides, nucleotides and nucleic acids: Structures and chemistry, DNA structures and their importance, · different types of RNA. Unusual DNA structures, other functions of nucleotides

Unit V Vitamins, coenzymes and metal ions, Occurrence and nutritional role. Coenzymes and their role in metabolism. Metal ion containing biomolecules - heme, porphyrins and cyanocobalamin; their biological significance. Signalling molecules: Second messengers - cAMP, cGMP, IP3, diacyl glycerol, Ca2+, NO. Brief account of their importance and role in signalling and signal transduction.

Suggested readings:

Lehninger: Principles of Biochemistry (2013) 6th ed., Nelson, D.L. and Cox, M.M., W.H. Freeman and Company (New York), ISBN:13; 978-1-4641-0962-1/ ISBN:10-14641-0962-1.

Textbook of Biochemistry with Clinical Correlations (2011) 7th ed., Devlin, T.M., John Wiley & Sons, Inc. (New York), ISBN:978-0-470-28173-4.

BH260103P: Practical I

1. Study of plasmolysis and de-plasmolysis
2. Study of structure of any Prokaryotic and Eukaryotic cell
3. Cell division in onion root tip/ insect gonads
4. Qualitative tests for carbohydrates
5. Qualitative tests for proteins
6. Quantitative tests for carbohydrates
7. Quantitative tests for proteins
8. Quantitative tests for nucleic acid
9. Separation of Lipids by TLC
10. Separation of Amino acids by TLC

VOCxxx: {Skill Enhancement course (SEC)}: Vocational Skill Enhancement course: As per Univ. Syllabus

Z011101 (Co-curricular Course): First Aid and Basic Health: As per Univ. Syllabus

SEM II

BH260201T: (Core Course – I): Mammalian Physiology

UNIT I- Digestion and Respiration: Digestion: Mechanism of digestion & absorption of carbohydrates, Proteins, Lipids and nucleic acids. Composition of bile, Saliva, Pancreatic, gastric and intestinal juice Respiration: Exchange of gases, Transport of 02 and C02, Oxygen dissociation curve, Chloride shift. IBasics of IKS

UNIT II- Circulation: Composition of blood, Plasma proteins & their role, blood cells, Haemopois is, Mechanism of coagulation of blood. Mechanism of working of heart: Cardiac output, cardiac cycle, Origin & conduction of heart beat.

UNIT Ill- Muscle physiology and osmoregulation: Structure of cardiac, smooth & skeletal muscl, threshold stimulus, All or None rule, single muscle twitch, muscle tone, isotonic and isometric contraction, Physical, chemical & electrical events of mechanism of muscle contraction. Excretion: modes of excretion, Ornithine cycle, Mechanism of urine formation.

UNIT IV- Nervous and endocrine coordination: Mechanism of generation & propagation of nerve impulse, structure of synapse, synaptic conduction, saltatory conduction, Neurotransmitters Mechanism of action of hormones (insulin and steroids) Different endocrine glands- Hypothalamus, pituitary, pineal, thymus, thyroid, parathyroid and adrenals, hypo & hyper-secretions.

Suggested reading:

Guyton, A.C. & Hall, J.E. (2006). Textbook of Medical Physiology. XI Edition. Hercourt Asia PTE Ltd./W.B. Saunders Company.

Tortora, G.J. & Grabowski, S. (2006). Principles of Anatomy & Physiology. XI Edition. John wiley & sons,In.

BH260202T: (Core Course-II): Plant Physiology

UNIT I- Plant water relations and micro & macro nutrients: Plant water relations: Importance of wate r to plant life, diffusion, osmosis, plasmolysis, imbibition, guttation, transpiration, stomata & their mechanism of opening & closing. Micro & macro nutrients: criteria for identification of essentiality of nutrients, roles and deficiency systems of nutrients, mechanism of uptake of nutrients, mechanism of food transport, IKS

UNIT II- Carbon and nitrogen metabolism: Photosynthesis- Photosynthesis pigments, concept of two photo systems, photphosphorylation, calvin cycle, CAM plants, photorespiration, compensation point Nitrogen metabolism- inorganic & molecular nitrogen fixation, nitrate reduction and ammonium assimilation in plants.

UNIT Ill- Growth and development: Growth and development: Definitions, phases of growth, growth curve, growth hormones (auxins, gibberlins, cytokinins, abscisic acid,

ethylene) Physiological role and mode of action, seed dormancy and seed germination, concept of photoperiodism and vernalization

Suggested reading:

Dickinson, W.C. 2000 Integrative Plant Anatomy. Harcourt Academic Press, USA.

Esau, K. 1977 Anatomy of Seed Plants. Wiley Publishers.

Fahn, A. 1974 Plant Anatomy. Pergmon Press, USA and UK.

Hopkins, W.G. and Huner, P.A. 2008 Introduction to Plant Physiology. John Wiley and Sons. 5.Mauseth, J.D. 1988 Plant Anatomy. The Benjammin/Cummings Publisher, USA.

Nelson, L, Cox, M.M. 2004. Lehninger Principles of Biochemistry, 4th edition, W.H. Freeman and Company, New York, USA.

Salisbury, F.B. and Ross, C.W. 1991 Plant Physiology, Wadsworth Publishing Co. Ltd. 8. Taiz, and Zeiger, E. 2006 Plant Physiology, 4th edition, Sinauer Associates Inc .MA, USA

BH260203P: Practical -II

1. Finding the coagulation time of blood
2. Determination of blood groups
3. Counting of mammalian RBCs
4. Determination of TLC and DLC
5. Determination of Haemoglobin
6. Preparation of stained mounts of anatomy of monocot and dicot's root, stem & leaf.
7. Demonstration of plasmolysis by leaf peel.
8. Demonstration of opening & closing of stomata
9. Demonstration of guttation on leaf tips of grass and garden nasturtium.
10. Separation of photosynthetic pigments by paper chromatography.

BH100204M Minor Course: IPR Entrepreneurship Bioethics & Biosafety

Unit I- Introduction to Indian Patent Law. World Trade Organization and its related intellectual property provisions. Intellectual/Industrial property and its legal protection in research, design and development. Patenting in Biotechnology, economic, ethical and depository considerations

Unit II- Entrepreneurship: Selection of a product, line, design and development processes, economics on material and energy requirement, stock the product and release the same or making etc. The basic regulations of excise: Demand for a given product, feasibility of its production under given constraints of raw material, energy input, financial situations export potential etc.

Unit III- Bioethics – Necessity of Bioethics, different paradigms of Bioethics – National & International. Ethical issues against the molecular technologies.

Unit IV- Biosafety- Introduction to biosafety and health hazards concerning biotechnology. Introduction to the concept of containment level and Good Laboratory Practices (GLP) and Good Manufacturing Practices (GMP).

VOCxxx: {Skill Enhancement course (SEC)} As per Univ. Syllabus

Z021201: Co-curricular Course): Human Values and Environment Studies: As per Univ. Syllabus

SEM III

BH260301T: (Core Course – I): General Microbiology

Unit I- Fundamentals, History and Evolution of Microbiology: Classification of microorganisms: Microbial taxonomy, criteria used including molecular approaches, Microbial phylogeny and current classification of bacteria. Microbial Diversity: Distribution and characterization Prokaryotic and Eukaryotic cells, Morphology and cell structure of major groups of microorganisms eg. Bacteria, Algae, Fungi, Protozoa and Unique features of viruses. Microbiology through IKS

Unit II- Cultivation and Maintenance of microorganisms: Nutritional categories of micro-organisms, methods of isolation, Purification and preservation

Unit Ill- Microbial growth: Growth curve, Generation time, synchronous batch and continuous culture, measurement of growth and factors affecting growth of bacteria. Microbial Metabolism: Metabolic pathways, amphi-catabolic and biosynthetic pathways Bacterial Reproduction: Transformation, Transduction and Conjugation. Endospores and sporulation in bacteria.

Unit IV- Control of Microorganisms: By physical, chemical and chemotherapeutic Agents Water Microbiology: Bacterial pollutants of water, coliforms and non coliforms. Sewage composition and its disposal. Food Microbiology: Important microorganism in food Microbiology: Moulds, Yeasts, bacteria. Major food born infections and intoxications, Preservation of various types of foods. Fermented Foods.

Suggested reading:

Alexopoulos CJ, Mims CW, and Blackwell M. (1996). Introductory Mycology. 4th edition. John and Sons, Inc.

Jay JM, Loessner MJ and Golden DA. (2005). Modern Food Microbiology. 7thedition, CBS Publishers and Distributors, Delhi, India.

Kumar HD. (1990) Introductory Phycology. 2nd edition. Affiliated East Western Press.

Madigan MT, Martinko JM and Parker J. (2009). Brock Biology of Microorganism. 12th edition. Pearson Benjamin Cummings.

Pelczar MJ, Chan ECS and Krieg NR. (1993). Microbiology. 5th edition. McGraw Hill Book Company.

BH260302T (Core Course -II): Fundamental of Genetics

Unit I- Introduction: Historical developments in the field of genetics. Organisms suitable for genetic experimentation and their genetic significance. Cell Cycle: Mitosis and Meiosis: Control points in cell-cycle progression in yeast. Role of meiosis in life cycles of organisms. Mendelian genetics: Mendel's experimental design, monohybrid, di-hybrid and tri hybrid crosses, Law of segregation & Principle of independent assortment. Verification of segregates by test and back crosses, Chromosomal theory of inheritance, Allelic interactions: Concept of dominance, recessiveness, incomplete dominance, co-dominance, semi-dominance, pleiotropy, multiple allele, pseudo-allele, essential and lethal genes, penetrance and expressivity. IKS

Unit II- Non allelic interactions: Interaction producing new phenotype complementary genes, epistasis (dominant & recessive), duplicate genes and inhibitory genes. Chromosome and genomic organization : Eukaryotic nuclear genome nucleotide sequence composition -unique & repetitive DNA, satellite DNA. Centromere and telomere DNA sequences, Genetic organization of prokaryotic and viral genome. Structure and characteristics of bacterial and eukaryotic chromosome, chromosome morphology, concept of euchromatin and heterochromatin. packaging of DNA molecule into chromosomes, chromosome banding pattern, karyotype, giant chromosomes, one gene one polypeptide hypothesis, concept of cistron, exons, intrans, genetic code, gene function.

Unit Ill- Chromosome and gene mutations: Definition and types of mutations, causes of mutations, Ames test for mutagenic agents, screening procedures for isolation of mutants and uses of mutants, variations in chromosomes structure - deletion, duplication, inversion and translocation (reciprocal and Robertsonian), position effects of gene expression, chromosomal aberrations in human beings, abonormalities- Aneuploidy and Euploidy. Sex determination and sex linkage: Mechanisms of sex determination, Environmental factors and sex determination, sex differentiation, Barr bodies, dosage compensation, genetic balance theory, Fragile-X-syndrome and chromosome, sex influenced dominance, sex limited gene expression, sex linked inheritance.

Unit IV- Genetic linkage, crossing over and chromosome mapping: Linkage and Recombination of genes in ·a chromosome crossing over, Cytological basis of crossing over, Molecular mechanism of crossing over, Crossing over at four strand stage, Multiple crossing overs Genetic mapping. Extra chromosomal inheritance: Rules of extra nuclear inheritance, maternal effects, maternal inheritance, cytoplasmic inheritance, organelle heredity, genomic imprinting

Suggested reading:

Gardner, E.J., Simmons, M.J., Snustad, D.P. {2006). Principles of Genetics. VIII Edition John Wiley & Sons.

Snustad, D.P., Simmons, M.J. {2009). Principles of Genetics. V Edition. John Wiley and Sons Inc.

Klug, W.S.,Cummings, M.R., Spencer, C.A. {2009). Concepts of Genetics. IX Edition. Benjamin Cummings.

Russell, P. J. (2009). Genetics- A Molecular Approach. Ill Edition. Benjamin Cummings.

Griffiths, A J.F., Wessler, S.R., Lewontin, R.C. and Carroll, S.B. IX Edition. Introduction to Genetic Analysis, W. H. Freeman & Co.

BH260303P: Practical -III

1. Isolation of bacteria & their biochemical characterization

2. Staining methods: simple staining, Gram staining, spore staining, negative staining, hanging drop.

3. Preparation of media & sterilization methods, Methods of Isolation of bacteria from different sources.

4. Determination of bacterial cell size by micrometry.

5. Enumeration of microorganism – total & viable count.

5. Permanent and temporary mount of mitosis.

6. Permanent and temporary mount of meiosis.

7. Mendelian deviations in dihybrid crosses

8. Karyotyping with the help of photographs

9. Pedigree charts of some common characters like blood group, color blindness and PTC tasting.

10. Study of polyploidy in onion root tip by colchicine treatment.

VOCxxx: {Skill Enhancement course (SEC)}: Vocational Skill Enhancement course: As per Univ. Syllabus

Z031301: (Co-curricular Course): Physical Education and Yoga: As per Univ. Syllabus

SEM VI

BH260401T: (Core Course – I): Intermediary Metabolism

Unit 1- Basic concepts and design of metabolism: The nature of metabolism. Role of oxidation and reduction and coupling of these. ATP as energy currency. Fundamentals of IKS

Unit 2- Carbohydrate metabolism: Glycolysis a universal pathway, fructose and galactose oxidation, anaerobic glycolysis, fermentation, gluconeogenesis, reciprocal regulation of glycolysis and gluconeogenesis. Glycogen metabolism: Glycogenolysis,

phosphorylase regulation, role of epinephrine and glucagon for glycogenolysis, glycogenesis; reciprocal regulation of glycogenesis and glycogenolysis.

Unit 3- The citric acid cycle: Pyruvate dehydrogenase complex, oxidation of acetyl CoA, amphibolic role, regulation and glyoxylate pathway.

Unit 4- Oxidative phosphorylation: The respiratory chain in mitochondria, proton gradient powering ATP synthesis, glycerol-3- phosphate and malate-aspartate shuttle, regulation of oxidative phosphorylation.

Unit 5- Photosynthesis, Calvin cycle and pentose phosphate pathway: The light reaction, chlorophyll, accessory pigments, reaction centres, two photo systems, generation of proton gradient and NADPH, Calvin cycle, synthesis of glucose, starch, sucrose, regulation, C4 pathway. Pentose phosphate pathway, importance and regulation.

Unit 6- Fatty acid synthesis and degradation: TAG as energy source, oxidation of fatty acids in mitochondria and peroxisomes, ketone bodies. Biosynthesis of fatty acids - elongation and unsaturation of fatty acids. Regulation of fatty acid oxidation and synthesis.

Unit 7- Amino acid and nucleotide metabolism: Protein degradation to amino acids, urea cycle. Nitrogen fixation, synthesis of non-essential amino acids. Biosynthesis - de novo and salvage pathways, regulation of nucleotide synthesis by feedback inhibition, degradation and excretion.

Suggested Readings:

Biochemistry, Lubert Stryer, 6th Edition, WH Freeman, 2006.

Harper's illustrated Biochemistry by Robert K. Murray, David A Bender, Kathleen

Biochemistry, Donald Voet and Judith Voet, 2nd Edition, Publisher: John Wiley and Sons, 1995.

Biochemistry by Mary K.Campbell & Shawn O.Farrell,5th Edition, Cenage Learning,2005.

BH260402T: (Core Course -II): Biophysical Chemistry and Techniques

Unit I- Simple microscopy, phase contrast microscopy, florescence and electron microscopy (TEM and SEM}, pH meter, absorption and emission spectroscopy

Unit II- Principle and law of absorption fluorimetry, colorimetry, spectrophotometry (visible, UV, infrared}, centrifugation, cell fractionation techniques, isolation of sub-cellular organelles and particles.

Unit III- Introduction to the principle of chromatography. Paper chromatography, thin layer chromatography, column chromatography: silica and gel filtration, affinity and ion exchange chromatography, gas chromatography, HPLC.

UNIT IV- Introduction to electrophoresis. Starch-gel, polyacrylamide gel (native and SOS-PAGE}, agarose-gel electrophoresis, pulse field gel electrophoresis, immuno-electrophoresis, isoelectric focusing, Western blotting. Introduction to Biosensors and Nanotechnology and their applications.

Suggested reading:

Freifelder D., Physical Biochemistry, Application to Biochemistry and Molecular Biology, 2nd Edition,

W.H. Freeman and Company, San Fransisco, 1982.

Keith Wilson and John Walker, Principles and Techniques of Practical Biochemistry, 5th Edition, Cambridge University Press, 2000.

D. Holme and H. Peck, Analytical Biochemistry, 3rd Edition, Longman, 1998.

BH260403P: Practical -IV

1. Alcohol fermentation by yeast.
2. Urea estimation
3. Uric acid estimation
4. SDS-polyacrylamide slab gel electrophoresis of proteins
5. Agarose gel electrophoresis of DNA
6. Isolation of cell organelles through centrifugation
7. Separation of amino acids by paper chromatography.
8. To identify lipids in a given sample by TLC.

BH100404M Minor Course: Medical Biotechnology:

Unit I: Vaccine technology: Immunity and vaccine; Childhood immunization program, Herd Immunity; Active immunization, Attenuated; Inactivated; Subunit vaccines; Recombinant and protein based vaccines, plant-based vaccines; conjugate vaccines; Passive Immunization; Monoclonal Antibody concept and applications. IKS

Unit II: Important therapeutic proteins: Functions, Uses and Production of Insulin, Growth Hormone, Factor VIII, Tissue-Plasminogen Activator, Erythropoietin; Interferon basic concept and application.

Unit III: Biotechnological methods of disease diagnosis and treatment- Microbiological; Immunological-agglutination, ELISA, Western blotting; Serological; Molecular diagnostics-PCR, Real time PCR, C_T value and viral load, Forensic medicine: DNA fingerprinting and DNA profiling, Imaging technologies

Unit IV: Drug targeting and delivery; In vitro fertilization and Embryo Transfer, Assisted Reproductive Technologies; Cryopreservation of sperm and ovum; Banking concept in

Biotechnology, Stem Cell therapy; Gene therapy; Concept of Tissue engineering, Organoids development; 3D Bioprinting, Production of Artificial tissues and organs, Commercialized products.

Suggested Readings:

1. F.C. Hay, O.M.R. Westwood, Practical Immunology, 4th Edition-, Blackwell Publishing, 2002
2. S. Hockfield, S. Carlson, C. Evans, P. Levitt, J. Pintar, L. Silberstein, Selected Methods for Antibody and Nucleic Acid probes, Volume 1, Cold Spring Harbor Laboratory Press, 1993.
3. Ed Harlow, David Lane, Antibodies Laboratory Manual, Cold Spring Harbor, Laboratory Press, 1988.
4. Gupta V et al (2016). Basics and Applied Aspects of Biotechnology, Springer International.
6. Levine, M. M. (2004). New Generation Vaccines. New York: M. Dekker.

BH260405R: Project: Research Project/Internship/Field Work

Z041401/Z041402: (Co-curricular Course): Social Responsibility and Community Engagement/Indian Language: As per Univ. Syllabus

SEM V

BH260501T: (Core Course – I): Molecular Biology

Unit I- DNA structure and replication: DNA as genetic material, Structure of DNA, Types of DNA, Replication of DNA in prokaryotes and eukaryotes: Semiconservative nature of DNA replication, Bi-directional replication, DNA polymerases, replication complex: Pre-primming proteins, primosome, replisome, Rolling circle replication, Unique aspects of eukaryotic chromosome replication, Fidelity of replication.

Unit II- DNA damage, repair and homologous recombination: DNA damage and repair: causes and types of DNA damage, mechanism of DNA repair: Photoreactivation, base excision repair, nucleotide excision repair, mismatch repair, translesion synthesis, recombinational repair, nonhomologous end joining. Homologous recombination: models and mechanism.

Unit Ill- Transcription and RNA processing: RNA structure and types of RNA, Transcription in prokaryotes: Prokaryotic RNA polymerase, role of sigma factor, promoter, Initiation, elongation and termination of RNA chains Transcription in eukaryotes : Eukaryotic RNA polymerases, transcription factors, promoters, enhancers, mechanism of transcription initiation, promoter clearance and elongation RNA splicing and processing: processing of pre-mRNA: 5' cap formation, polyadenylation, splicing, rRNA and tRNA splicing.

Unit IV- Regulation of gene expression and translation: Regulation of gene expression in prokaryotes : Operon concept (inducible and repressible system), Genetic code and its characteristics, Prokaryotic and eukaryotic · translation:

ribosome structure and assembly, Charging of tRNA, aminoacyl tRNA synthetases, Mechanism of initiation, elongation and termination of polypeptides, Fidelity of translation, Inhibitors of translation, Posttranslational modifications of proteins.

Suggested reading:

Freifelder, DM "Molecular Biology"

Karp, G. (2010) Cell and Molecular Biology: Concepts and Experiments. VI Edition. John Wiley & Sons. Inc

BH260502T: (Core Course -II): Immunology

Unit I- Immune Response: An overview, components of mammalian immune system, molecular structure of Immuno-globulins or Antibodies, Humoral & Cellular immune responses, T lymphocytes & immune response (cytotoxic T-cell, helper T-cell, suppressor T-cells), T-cell receptors, genome rearrangements during B-lymphocyte differentiation, Antibody affinity maturation class switching, assembly of T-cell receptor genes by somatic recombination.

Unit II- Re gulation of immunoglobulin gene expression: Clonal selection theory, allotypes & idiotypes, allelic exclusion, immunologic memory, heavy chain gene transcription, genetic basis of antibody diversity, hypotheses (germ line & somatic mutation), antibody diversity.

Unit Ill- Major Histocompatibility complexes: class I & class II MHC antigens, antigen processing. Immunity to infection – immunity to different organisms, pathogen defense strategies, avoidance of recognition. Autoimmune diseases, Immunodeficiency-AIDS.

Unit IV- Vaccines & Vaccination: Adjuvants, cytokines, DNA vaccines, recombinant vaccines, bacterial vaccines, viral vaccines, vaccines to other infectious agents, passive & active immunization. Introduction to immunodiagnostics – RIA, ELISA.

Suggested readings:

Abbas AK, Lichtman AH, Pillai S. (2007). Cellular and Molecular Immunology. 6 th edition Saunders Publication, Philadelphia.

Delves P, Martin S, Burton D, Roitt IM. (2006). Roitt's Essential Immunology. 11th edition Wiley-Blackwell Scientific Publication, Oxford.

Goldsby RA, Kindt TJ, Osborne BA. (2007). Kuby's Immunology. 6th edition W.H. Freeman and Company, New York. .

Murphy K, Travers P, Walport M. (2008). Janeway's Immunobiology. 7th edition Garland Science Publishers, New York.

BH260503T: (Core Course – III): Enzymology

Unit I- Isolation, crystallization and purification of enzymes, Enzyme classification (rationale, overview and specific examples) Zymogens and their activation (Proteases and Prothrombin). Enzyme substrate complex: concept of E-S complex, binding sites, active site, specificity, Kinetics of enzyme activity, Michaelis-Menten equation and its derivation.

Unit II- Two substate reactions (Random, ordered and ping-pong mechanism) Enzyme inhibition types of inhibition, determination of Ki, suicide inhibitor. Mechanism of enzyme action Enzyme regulation: Product inhibition, feedback control, covalent modification.

Unit Ill- Allosteric enzymes with special reference to aspartate transcarbomylase and phosphofructokinase. concerted and sequential models. Negative cooperativity and half site reactivity. kinetics of allosteric enzymes. lsoenzymes- multiple forms of enzymes with special reference to lactate dehydrogenase. Multienzyme complexes. Ribozymes.

Unit IV- Enzyme Technology: Methods for large scale production of enzymes. Immobilized enzyme and their comparison with soluble enzymes, Methods for immobilization of enzymes. Immobilized enzyme reactors. Application of Immobilized and soluble enzyme in health and industry.

Suggested Readings:

Biochemistry, Lubert Stryer, 6th Edition, WH Freeman, 2006.

Harper's illustrated Biochemistry by Robert K. Murray, David A Bender, Kathleen M.Botham, Peter J. Kennelly, Victor W. Rodwell, P. Anthony Weil. 28th Edition, McGrawHill, 2009.

Biochemistry, Donald Voet and Judith Voet, 2nd Edition, Publisher: John Wiley and Sons, 199.

Biochemistry by Mary K.Campbell & Shawn O.Farrell, 5th Edition, Cenage Learning,2005.

Fundamentals of Enzymology Nicholas Price and Lewis Stevens Oxford University Press 1999

Fundamentals of Enzyme Kinetics Athel Cornish-Bowden Portland Press 2004

Practical Enzymology Hans Bisswanger Wiley-VCH 2004

BH260504T: (Core Course -IV): Biostatistics

Unit I- Types of Data, Collection of data; Primary & Secondary data, Classification and Graphical representation of Statistical data. Measures of central tendency and Dispersion. Measures of Skewness and Kurtosis

Unit I!- Probability classical & axiomatic definition of probability, Theorems on total and compound probability), Elementary ideas of Binomial, Poisson and Normal distributions.

Unit Ill- Methods of sampling, confidence level, critical region, testing of hypothesis and standard error, large sample test and small sample test. Problems on test of significance, t-test, chi-square test for goodness of fit and analysis. of variance (ANOVA)

Unit IV- Correlation and Regression. Emphasis on examples from Biological Sciences.

BH260505P: Practical – V

1. Isolation of chromosomal DNA from bacterial cells.
2. Isolation of Plasmid DNA by alkaline lysis method
3. Agarose gel electrophoresis of genomic DNA & plasmid DNA
4. Haemagglutination assay
5. Haemagglutination inhibition assay
6. Separation of serum from blood
7. Double immunodiffusion test using specific antibody and antigen.
9. ELISA.
9. Purification of an enzyme from any natural resource
1o. Perform assay for the purified enzyme

BH260506R: (Research Project): Research Project on topics which are Inter/Intra faculty

SEM VI

BH260601T: (Core Course – I): Principles of Genetic Engineering

Unit I- Molecular tools and applications-, restriction enzymes, ligases, polymerases, alkaline phosphatase. Gene Recombination and Gene transfer: Transformation, Episomes, Plasmids and other cloning vectors {Bacteriophage-derived vectors, artificial chromosomes), Microinjection, Electroporation, Ultrasonication, Principle and applications of Polymerase chain reaction {PCR), primer-design, and RT- {Reverse transcription) PCR.

Unit II- Restriction and modification system, restriction mapping. Southern and Northern hybridization. Preparation and comparison of Genomic and cDNA library, screening of recombinants, reverse transcription, Genome mapping, DNA fingerprinting, Applications of Genetic Engineering Genetic engineering in animals: Production and applications of transgenic mice.

Neeraja.

Unit III- Random and site-directed mutagenesis: Primer extension and PCR based methods of site directed mutagenesis, Random mutagenesis, Gene shuffling, production of chimeric proteins, Protein engineering concepts and examples (any two).

Unit IV- Genetic engineering in plants: Use of Agrobacterium tumefaciens and A. rhizogenes, Ti plasmids, Strategies for gene transfer to plant cells, Direct DNA transfer to plants, Gene targeting in plants, Use of plant viruses as episomal expression vectors.

Suggested reading:

Brown TA. (2006). Gene Cloning and DNA Analysis. 5th edition. Blackwell Publishing, Oxford, U.K.

Clark' DP and Pazdernik NJ. {2009). Biotechnology-Applying the Genetic Revolution. Elsevier Academic Press, USA.

Glick, B.R, Pasternak, J.J. {2003). Molecular Biotechnology- Principles and Applications of recombinant DNA. ASM Press, Washington

Primrose SB and Twyman RM. {2006). Principles of Gene Manipulation and Genomics, 7th edition. Blackwell Publishing, Oxford, U.K.

BH260602T: (Core Course -II): Environmental Biology

Unit 1- Introduction to environmental studies: Multidisciplinary nature of environmental studies; Scope and importance; Concept of sustainability and sustainable development.

Unit 2- Ecosystems: What is an ecosystem? Structure and function of ecosystem; Energy flow in an ecosystem: food chains, food webs and ecological succession. Case studies of the ecosystems

Unit 3- Natural Resources: Renewable and Non-renewable Resources, Land resources and land use change; Land degradation, soil erosion and desertification. Deforestation, Use and over-exploitation of surface and ground water, floods, droughts, conflicts over water (international & interstate)., growing energy needs, case studies.

Unit 4- Biodiversity and Conservation: Levels of biological diversity: genetic, species and ecosystem diversity; Biogeographic zones of India; Biodiversity patterns and global biodiversity hot spots, India as a mega-biodiversity Endangered and endemic species of India, Threats to biodiversity, Conservation of biodiversity. Ecosystem and biodiversity services

Unit 5- Environmental Pollution: Environmental pollution: types, causes, effects and controls; Air, water, soil and noise pollution, nuclear hazards and human health risks, Solid waste management: Control measures of urban and industrial waste. Pollution case studies.

Unit 6- Environmental Policies & Practices: Climate change, global warming, ozone layer depletion, acid rain and impacts on human communities and agriculture

Environment Laws, International agreements, Nature reserves, tribal populations and rights, and human wildlife conflicts in Indian context.

Unit 7- Human Communities and the Environment: Human population growth: Impacts on environment, human health and welfare. Resettlement and rehabilitation of project affected persons; case studies. Disaster management, Environmental movements, Environmental ethics, Environmental communication and public awareness, case studies

Suggested Readings:

Carson, R. 2002. Silent Spring. Houghton Mifflin Harcourt.

Gadgil, M., & Guha, R. 1993. This Fissured Land: An Ecological History of India. Univ. of California Press. 3. Gleeson, B. and Low, N. (eds.) 1999. Global Ethics and Environment, London, Routledge.

Gleick, P. H. 1993. Water in Crisis. Pacific Institute for Studies in Dev., Environment & Security. Stockholm Env. Institute, Oxford Univ. Press.

Groom, Martha J., Gary K. Meffe, and Carl Ronald Carroll. Principles of Conservation Biology.

Sunder land: Sinauer Assoc iates, 2006.

Grumbine, R. Edward, and Pandit, M.K. 2013. Threats

Singh, J S., Singh S.P. and Gupta, S.R. 2014. Ecology, Environmental Science and Conservation. S. Chand Publishing, New Delhi.

Sodlii, N.S., Gibson, L. & Raven, P.H. (eds). 2013. Conservation Biology: Voices from the Tropics. John Wiley & Sons.

BH260603T: (Core Course – III): Fermentation Technology

Unit I- Introduction: Fermentation process, Importance of Fermented products, Isolation and maintenance of culture, Preparation of substrates/media, inoculums, Rate of microbial growth and death, Fermentation Kinetics,

Unit II- Fermentation Technology: Types of fermentation sub-merged/solid state, Batch/continuous fermentation, Fermenter design, operation, measurement and control in fermentation, Recovery of fermentation products and conversion into marketable/storage forms, Aeration and agitation in fermentation: Oxygen requirement, sterilization of air and media, Scale up in fermentation.

Unit III- Fermented Products: Production of baker's yeast, food yeast, Single Cell Protein, Beer, Wine, Cider, Vinegar, Cheese Lactic acid Fermentation of milk, vegetables, cereals, Mushroom cultivation, IMFL/distilled spirits.

Suggested Readings:

Casida LE. (1991). Industrial Microbiology. lst edition. Wiley Eastern Limited.

Crueger W and Crueger A. (2000). Biotechnology: A textbook of Industrial Microbiology. 2nd edition. Panima Publishing Co. New Delhi.

Patel AH. (1996). Industrial Microbiology. lst edition, Macmillan India Limited.

Stanbury PF, Whitaker A and Hall SJ. (2006). Principles of Fermentation Technology. 2nd edition, Elsevier Science Ltd.

BH260604T: (Core Course -IV): Bioinformatics

Unit I- History of Bioinformatics. The notion of Homology. Sequence Information Sources, EMBL, GENBANK, Entrez, Unigene, Understanding the structure of each source and using it on the web.

Unit II- Protein Information Sources, PDB, SWISSPROT, TREMBL, Understanding the structure of each source and using it on the web. Introduction of Data Generating Techniques and Bioinformatics problem posed by them- Restriction Digestion, Chromatograms, Blots, PCR, Microarrays, Mass Spectrometry.

Unit Ill- Sequence and Phylogeny analysis, Detecting Open Reading Frames, Outline of sequence Assembly, Mutation/Substitution Matrices, Pairwise Alignments, Introduction to BLAST, using it on the web, Interpreting results, Multiple Sequence Alignment, Phylogenetic Analysis.

Unit IV- Searching Databases: SRS, Entrez, Sequence Similarity Searches-BLAST, FASTA, Data Submission. Genome Annotation: Pattern and repeat finding, Gene identificati_on tools.

Suggested reading:

Ghosh Z. and Bibekanand M. (2008) Bioinformatics: Principles and Applications. Oxford University Press.

Pevsner J. (2009) Bioinformatics and Functional Genomics. II Edition. Wiley-Blackwell.

Campbell A. M., Heyer L. J . (2006) Discovering Genomics, Proteomics and Bioinformatics. II Edition. Benjamin Cummings.

BH260605P: Practical – VI

1. Isolation of chromosomal DNA from plant cells
2. quantitative analysis of DNA using spectrophotometer
3. Plasmid DNA isolation
4. Demonstration of PCR
5. Visit to an area to document environmental assets: river/ forest/ flora/fauna, etc.

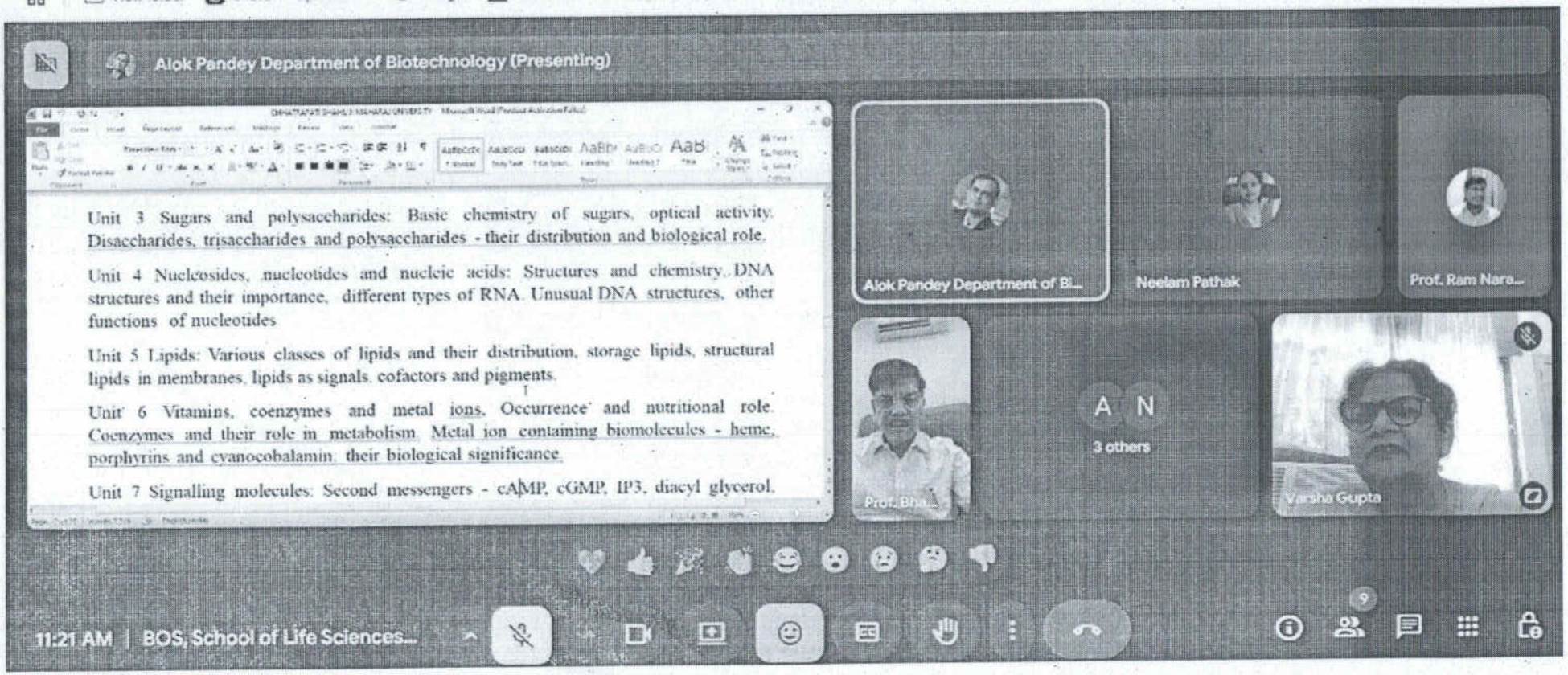
6. Visit to local polluted site- Urban/Rural/Industrial/ Agricultural.

7. Fermentation of sugars by yeasts

8. Production of Baker's Yeast.

9. Understanding and use of various web' resources: EMBL, Genbank, Entrez, Unigene, Protein information resource (PIR)

BH260606R: (Research Project): Research Project on topics which are Inter/Intra faculty


meet.google.com/uvc-ypej-bqc?authuser=2
Relaunch to update
New folder
ChatGPT: Optimizin...
Google
Yahoo! UK
http://www.google....
Errors Page
vcslids3.pdf
Mapping Genomes...
All Bookmarks
Alok Pandey Department of Biotechnology (Presenting)
Unit 3 Sugars and polysaccharides: Basic chemistry of sugars, optical activity. Disaccharides, trisaccharides and polysaccharides - their distribution and biological role.
Unit 4 Nucleosides, nucleotides and nucleic acids: Structures and chemistry. DNA structures and their importance, different types of RNA. Unusual DNA structures, other functions of nucleotides
Unit 5 Lipids: Various classes of lipids and their distribution, storage lipids, structural lipids in membranes, lipids as signals, cofactors and pigments.
Unit 6 Vitamins, coenzymes and metal ions. Occurrence and nutritional role. Coenzymes and their role in metabolism. Metal ion containing biomolecules - heme, porphyrins and cyanocobalamin: their biological significance.
Unit 7 Signalling molecules: Second messengers - cAMP, cGMP, IP3, diacyl glycerol.
Alok Pandey Department of Bi...
Neelam Pathak
Prof. Ram Nara...
Prof. Bha...
A N
3 others
Varsha Gupta
11:21 AM | BOS, School of Life Sciences...