

## **DYAL SINGH COLLEGE, KARNAL**

### **Lesson Plan (2023-24) ODD Semester**

**Class:** B.Sc. Med. 1<sup>st</sup> Sem

**Subject:** Biotechnology

Week 1 ( July 24-29)	Introduction to biotechnology – an interdisciplinary pursuit; Main areas of application of biotechnology
Week 2 ( August 1-5)	Biotechnology research in India and biotechnology in context of developing world; Public perception of biotechnological products
Week 3 ( August 7-12)	Brief account of safety guidelines, risk assessment and ethics in biotechnology;
Week 4 ( August 14-18)	Very brief account of intellectual property rights; Substrates (raw materials) and the future of biotechnology
Week 5 ( August 21-26)	In brief scope and techniques of preservation. Introduction of fermentation technology
Week 6 ( August 28-September 2)	Introduction of animal tissue culture (brief of history, culture media, substrate surfaces, culture procedures, primary cultures, cell lines, organ culture and tissue engineering etc.
Week 7 (September 4 -9)	Introduction of plant tissue culture (in brief history, culture media, explants, totipotency, dedifferentiation and types of cell & tissue culture etc.)
Week 8 (September 11 -16)	Scope and applications of animal biotechnology and plant biotechnology.
Week 9 (September 18 -22)	Brief account of immunotechnology: immune system (immune cells, types of immunity and general structure of immunoglobulins)
Week 10 (September 25 -30)	hybridoma technology and monoclonal antibodies. In vitro fertilization and embryo transfer technology in brief
Week 11 (October 3-7)	Introduction of genetic engineering, gene and genomes, proteins and proteome, history of genetic manipulations, DNA fingerprinting and forensic analysis
Week 12 (October 9-14)	Industrial genetics, Potential laboratory biohazards of genetic engineering. Introduction to molecular markers and genetic mapping
Week 13 (October 16 - 21)	Introduction of enzyme technology: nature of enzymes, application of enzymes and immobilized enzymes.
Week 14 (October 23-31)	An overview, scope and market of biological control of environment. Brief account on bioremediation and waste treatment biotechnology
Week 15 (November 2-9)	Sessional Exams
Week 16 (November 10-16)	Diwali Break
November 17	Sessional MDC
November 18	Revision / Distribution of sessional exams answer sheets

Week 17 (November 20-24)	microbial insecticides, biofertilizers, microbes in oil recovery and bioleaching.
Week 18 (November 28-December 2)	Application of biotechnology in medicine (pharmaceutical industry, vaccines, antibiotics etc.), food industry, biofuels and chemical industry
Week 19 (December 4- 9)	Practical exam
Week 20 (December (11-16)	Practical exam
Week 21 (December (18-23)	Revision



**Head**  
**Department of Biotechnology**

# **DYAL SINGH COLLEGE, KARNAL**

## **Lesson Plan (2023-24) ODD Semester**

**Class:** B.Sc. Med. 1<sup>st</sup> Sem (Minor)

**Subject:** Laboratory Techniques & Practices

Week 1 ( July 24-29)	-----
Week 2 ( August 1-5)	Lab rules and safety measures to be taken in Biotechnology Lab.,
Week 3 ( August 7-12)	Commonly used equipments for Biotechnological work ,Laminar air-flow, Centrifuge, pH meter, Incubator,
Week 4 ( August 14-18)	Fermenter, Colony-counter, Autoclave, Inoculating loop and needle, Use of bright-field microscope,
Week 5 ( August 21-26)	Colorimeter and spectrophotometer.
Week 6 ( August 28-September 2)	Qualitative and quantitative estimation of various biomolecules- sugars, proteins;
Week 7 (September 4 -9)	Determination of various metabolites in given biological samples,
Week 8 (September 11 -16)	Preparation of standard curve, Preparation of buffers,
Week 9 (September 18 -22)	Preparation of normal, molar, percent solutions, buffer solutions and determination of their pH,
Week 10 (September 25 -30)	Thin-layer, Paper and Two-dimensional Chromatography, Paper electrophoresis.
Week 11 (October 3-7)	Sterilization techniques followed in biotechnology lab.- dry and wet sterilization techniques, Preferred method of sterilization for different materials,
Week 12 (October 9-14)	Biological indicators for checking the efficiency of sterilization process, Evaluation of different disinfectants and antiseptics and their usage.
Week 13 (October 16 - 21)	Microorganisms, Preparation of cotton plugs and different types of culture media for growth of microorganisms, animal and plant cell culture media,
Week 14 (October 23-31)	Preparation of dilutions and isolation of microorganisms from air, water and soil, subculturing/ Picking off technique- streaking, pour-plate, spread plate methods.
Week 15 (November 2-9)	Sessional Exams
Week 16 (November 10-16)	Diwali Break

November 17	Sessional MDC
November 18	Revision / Distribution of sessional exams answer sheets
Week 17 (November 20-24)	Revision
Week 18 (November 28- December 2)	Revision
Week 19 ( December 4- 9)	Practical exam
Week 20 (December (11-16)	Practical exam
Week 21 (December (18-23)	Revision



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# **DYAL SINGH COLLEGE, KARNAL**

## **Lesson Plan (2023-24) ODD Semester**

**Class: B.A & B.Com 1<sup>st</sup> Sem**

**Subject: MDC Biotechnology**

Week 1 ( July 24-29)	-----
Week 2 ( August 1-5)	Cell: Structure and Function: Cell theory and cell as the basic unit of life, structure of prokaryotic and eukaryotic cells
Week 3 ( August 7-12)	Plant cell and animal cell; cell envelope; cell membrane, cell wall; cell organelles - structure and function; endomembrane system, endoplasmic reticulum, golgi bodies, lysosomes, vacuoles,
Week 4 ( August 14-18)	Mitochondria, ribosomes, plastids, microbodies; cytoskeleton, cilia, flagella, centrioles (ultrastructure and function); nucleus,
Week 5 ( August 21-26)	Cell cycle, mitosis, meiosis and their significance.
Week 6 ( August 28-September 2)	The Living World Biodiversity: Need for classification; three domains of life; taxonomy and systematics; concept of species and taxonomical hierarchy;
Week 7 (September 4 -9)	binomial nomenclature. Biological Classification: classification of
Week 8 (September 11 -16)	Five kingdom classification, salient features and Monera, Protista
Week 9 (September 18 -22)	Fungi into major groups; Lichens, Viruses and Viroids.
Week 10 (September 25 -30)	Plant Kingdom: Classification of plants into major groups; Salient and distinguishing features
Week 11 (October 3-7)	A few examples of Algae, Bryophyta, Pteridophyta, Gymnosperms,
Week 12 (October 9-14)	Angiosperms, Plant Life Cycle and Alternation of Generations.
Week 13 (October 16 - 21)	Animal Kingdom: Salient features and classification of animals, levels of organization (cellular/tissue/organ), symmetry (radial, bilateral), phylum, porifera, Coelenterata, Ctenophora, Platyhelminthes,
Week 14 (October 23-31)	Aschelminthes, Annelida, Arthropoda, Mollusca, Echinodermata, hemichordata, chordata
Week 15 (November 2-9)	Sessional Exams
Week 16 (November 10-16)	Diwali Break
November 17	Sessional MDC

November 18	Revision / Distribution of sessional exams answer sheets
Week 17 (November 20-24)	Revision
Week 18 (November 28-December 2)	Revision
Week 19 ( December 4- 9)	Practical exam
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Week 21 (December (18-23)	Revision



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# **DYAL SINGH COLLEGE, KARNAL**

## **Lesson Plan (2023-24) EVEN Semester**

**Class: B.Sc. Med. 2<sup>nd</sup> Sem**

**Subject: Biotechnology**

Week 1 ( January 1-6)	History and evolution of microbiology with special reference to the contribution of the scientists: A. V. Leeuwenhoek, Louis Pasteur, Robert Koch, Edward Jenner and Alexander Fleming.
Week 2 ( January 8-13)	Introduction to classification of microorganisms: Microbial taxonomy, different criteria including molecular approaches, Microbial phylogeny and current classification of bacteria.
Week 3 ( January 15-20)	Stains and staining procedures: Acidic, basic and neutral stains, Gram staining, Acid fast staining, Flagella staining, Endospore staining..
Week 4 ( January 22-27)	Distribution and characterization: Prokaryotic and Eukaryotic cells, Morphology and cell structure of major groups of microorganisms eg. Bacteria, Algae, Fungi and Protozoa
Week 5 (January 29- February 3)	Cultivation and Maintenance of microorganisms: Nutritional requirements of microorganisms. Methods of isolation, purification and preservation of microorganisms. Microbial growth: Study of growth curve, generation time, quantitative measurement of growth and factors affecting growth of bacteria.
Week 6 ( February 5-10)	Bacterial Reproduction: Transformation, Transduction and Conjugation. Endospores and sporulation in bacteria.
Week 7 ( February 12-17)	Viruses: General characteristics of viruses, difference between virus and typical microbial cell, structure, different shapes and symmetries with one example of each type,
Week 8 ( February 19-23)	Classification of viruses on the basis of nucleic acids, phage and animal cell viruses, example of each and their importance.
Week 9 ( February 26 March 2)	Brief idea of lytic cycle and lysogeny. Revision Test
Week 10 (March 4-9)	Control of microorganisms: By physical and chemical antimicrobial agents including antibiotics and their mode of action.
Week 11 (March 11-16)	Food and Water Microbiology: Bacterial pollutants of water, coliforms and non coliforms. Sewage composition and its disposal.
Week 12 (March 18-22)	Microbial spoilage of foods. Major food born infections and intoxications.
Week 13 ( March 23-31)	Holi Break

Week 14 (April 1-6)	Microbiology of fermented Foods. Microbial ecology: Microenvironment & Niche.
Week 15 (April 8-13)	Soil microbiology: Types & functions of microorganisms in soil.
Week 16 (April 15-20)	Revision
Week 17 (April 22- 30)	Revision



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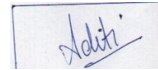
## Lesson Plan (2023-24) EVEN Semester

Class: B.Sc. Med. 2<sup>nd</sup> Sem

Subject: Biotechnology Minor

Week 1 ( January 1-6)	Basic constituents of matter - elements, atoms, isotopes, atomic weights, atomic numbers, basics of mass spectrometry, molecules, Avogadro number,
Week 2 ( January 8-13)	Molarity, Molality, Normality, gas constant, molecular weights, structural and molecular formulae, ions and polyatomic ions
Week 3 ( January 15-20)	Chemical reactions, reaction stoichiometry, rates of reaction, rate constants, order of reactions, Arrhenius equation,
Week 4 ( January 22-27)	Maxwell Boltzmann distributions, rate-determining steps,
Week 5 (January 29- February 3)	. Catalysis, free-energy, entropy and enthalpy changes during reactions;
Week 6 ( February 5-10)	kinetic versus thermodynamic controls of a reaction, reaction equilibrium (equilibrium constant).
Week 7 ( February 12-17)	Light and matter interactions (optical spectroscopy, fluorescence, bioluminescence);
Week 8 ( February 19-23)	Chemical bonds (ionic, covalent, Van der Waals forces);
Week 9 ( February 26 March 2)	States of matter - vapor pressure, surface tension, boiling and melting points, solubility, capillary action, suspensions, colloids and solutions;
Week 10 (March 4-9)	Acids, Bases and pH - Arrhenius theory, Ionic product of water, weak acids and bases, conjugate acid-base pairs, buffers.
Week 11 (March 11-16)	Types of organic reactions (Substitution, Addition, Elimination, Rearrangement etc.).
Week 12 (March 18-22)	Revision
Week 13 ( March 23-31)	Holi Break
Week 14 (April 1-6)	Concept of isomerism: Types of isomerism, Optical isomerism, elements of symmetry, molecular chirality, enantiomers, chiral and achiral molecules.
Week 15 (April 8-13)	Geometric isomerism: Configuration of geometric isomers. Cis-Trans nomenclature. Redox reactions and electrochemistry - oxidation-reduction reactions.
Week 16 (April 15-20)	Revision

Week 17 (April 22- 30)	Revision
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# DYAL SINGH COLLEGE, KARNAL

## **Lesson Plan (2023-24) EVEN Semester**

**Class: B.A. & B.Sc 2<sup>nd</sup> Sem**

**Subject: MDC Biotechnology**

Week 1 ( January 1-6)	Plant Physiology: Plant water relations; osmosis, plasmolysis, imbibition, mineral nutrition; plant nutrients, micro and macro nutrients, role of nutrients. Photosynthesis in Higher Plants: Photosynthesis as a means of autotrophic nutrition; site of photosynthesis, pigments involved in photosynthesis ;
Week 2 ( January 8-13)	photochemical and biosynthetic phases of photosynthesis; cyclic and non-cyclic photophosphorylation; chemiosmotic hypothesis; photorespiration; C <sub>3</sub> and C <sub>4</sub> pathways; factors affecting photosynthesis
Week 3 ( January 15-20)	. Respiration in Plants : Exchange of gases; cellular respiration - glycolysis, fermentation (anaerobic), TCA cycle and electron transport system (aerobic); energy relations - number of ATP molecules generated; amphibolic pathways; respiratory quotient.
Week 4 ( January 22-27)	Plant - Growth and Development :Seed germination; phases of plant growth and plant growth rate; conditions of growth; differentiation, dedifferentiation and redifferentiation; sequence of developmental processes in a plant cell; growth regulators - auxin, gibberellin, cytokinin, ethylene, ABA;
Week 5 (January 29- February 3)	Human Physiology: Breathing and Exchange of Gases: Respiratory organs in animals (recall only); Respiratory system in humans; mechanism of breathing and its regulation in humans - exchange of gases, regulation of respiration, respiratory volume; disorders related to respiration - asthma, emphysema, occupational respiratory disorders. transport of gases and Body
Week 6 ( February 5-10)	Fluids and Circulation: Composition of blood, blood groups, coagulation of blood; composition of lymph and its function; human circulatory system - Structure of human heart and blood vessels; cardiac cycle, cardiac output, ECG; double circulation; regulation of cardiac activity; disorders of circulatory system - hypertension, coronary artery disease, angina pectoris, heart failure
Week 7 ( February 12-17)	Excretory Products and their Elimination: Modes of excretion - ammonotelism, ureotelism, uricotelism; human excretory system – structure and function; urine formation, osmoregulation

Week 8 ( February 19-23)	Regulation of kidney function - renin - angiotensin, atrial natriuretic factor, ADH and diabetes insipidus; role of other organs in excretion; disorders - uremia, renal failure, renal calculi, nephritis; dialysis and artificial kidney, kidney transplant.
Week 9 ( February 26 March 2)	Locomotion and Movement Types of movement - ciliary, flagellar, muscular; skeletal muscle, contractile proteins and muscle contraction;
Week 10 (March 4-9)	skeletal system and its functions; joints; disorders of muscular and skeletal systems - myasthenia gravis, tetany, muscular dystrophy, arthritis, osteoporosis, gout.
Week 11 (March 11-16)	Neural Control and Coordination: Neuron and nerves; Nervous system in humans - central nervous system; peripheral nervous system and visceral nervous system; generation and conduction of nerve impulse. Chemical Coordination and Integration :
Week 12 (March 18-22)	Endocrine glands and hormones; human endocrine system - hypothalamus, pituitary, pineal, thyroid, parathyroid, adrenal, pancreas, gonads; mechanism of hormone action (elementary idea);
Week 13 ( March 23-31)	Holi Break
Week 14 (April 1-6)	Role of hormones as messengers and regulators, hypo - and hyperactivity and related disorders; dwarfism, acromegaly, cretinism, goiter, exophthalmic goitre, diabetes,
Week 15 (April 8-13)	Addison's disease. Note: Diseases related to all the human physiological systems to be taught in brief.
Week 16 (April 15-20)	Revision
Week 17 (April 22- 30)	Revision



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# DYAL SINGH COLLEGE, KARNAL

## Lesson Plan (2023-24) ODD Semester

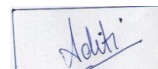
Class: B.Sc. Med. 3<sup>rd</sup> Sem

Subject: Biotechnology

Week 1 ( July 24-29)	-----
Week 2 ( August 1-5)	Immunology: Introduction, History and Scope. Terminology of immune system, Immunity: Definition, types of Immunity- Innate, Adaptive/acquired (active, passive, natural/artificial, Humoral and Cell mediated immunity). Introduction to molecular aspects of life. DNA as the genetic material – experiments proving DNA and RNA as genetic material. Nucleic acids: Structure, function and properties of DNA and RNA. Watson and Crick model of DNA. DNA forms (A, B and Z), their characteristic. Different types of RNA, their structure and function.
Week 3 ( August 7-12)	Features of Immune Response – memory, cell specificity/diversity, recognition of self and non-self. Cells of the Immune System – B and T cells (types and receptors), Null cells, Monocytes, Polymorphs., Organization of Genomes – bacterial, viral, human, organelles. Eukaryotic genomes: Chromosomal organization and structure. Euchromatin, heterochromatin, centromere, telomere.
Week 4 ( August 14-18)	Organs of the Immune System: Primary and Secondary Lymphoid organs- Thymus, Spleen, Lymph nodes., Chromatin structure (nucleosome), histone and non-histone proteins. Insertion elements and transposons; IS elements, transposable elements of Maize and P elements of Drosophila. Extra chromosomal DNA in prokaryotes – plasmids.
Week 5 ( August 21-26)	Antigens: Concept, Types of Antigens, Antigenic determinants/epitopes, Hapten. Antigen and Immunogen. Antigenicity and Immunogenicity. Factors affecting antigenicity., DNA Replication: Central dogma of molecular biology. Semi-conservative mode of DNA replication, experimental proof. Unidirectional and bidirectional mode of DNA replication, theta model and rolling circle model. DNA replication in prokaryotes and eukaryotes, different stages, proteins and enzymes involved.
Week 6 ( August 28-September 2)	Antibodies: Structure, Types/Classes, properties and functions of immunoglobulins. Production of antibodies. DNA damage and repair: causes of DNA damage, mutations. Repair mechanisms- photo reactivation, excision

	repair, mismatch repair, SOS repair
Week 7 (September 4 -9)	Antibody diversity (a brief account only). Antigen – Antibody Interactions: Binding sites, Binding forces, Affinity, Avidity, Cross Reactions, Genetic Code: concept, elucidation or cracking of genetic code, features of genetic code, Wobble hypothesis. Structure of gene- introns/exons, regulatory sequences, structure of prokaryotic gene.
Week 8 (September 11 -16)	Precipitation and Agglutination reactions, RIA, ELISA etc. techniques, Transcription in prokaryotes and eukaryotes, diff. stages, mechanism, promoters, transcription factors, RNA polymerases.
Week 9 (September 18 -22)	Immune Response: Introduction, Humoral Immunity – Primary and Secondary immune response – B cells in antibody formation (differentiation, maturation and activation of B cells). Post transcriptional modifications- 5' cap formation, 3'-end processing/polyadenylation and gene splicing and generation of mature mRNA. Inhibitors of transcription.
Week 10 (September 25 -30)	Role of MHC molecules, Antigen presenting cells. Factors influencing antibody formation. Cell mediated immunity- Cells involved in CMI, (T-cell subset and surface markers, Translation/Protein synthesis: Mechanism of initiation, elongation and termination of protein synthesis in prokaryotes and eukaryotes. Inhibitors of translation.
Week 11 (October 3-7)	T-dependent and T-independent antigens, recognition of antigens by T-cells, role of MHC and MHC restriction), cytokines and lymphokines, functions of cell mediated immunity. Post-translational modifications. Regulation of Gene Expression in prokaryotes and eukaryotes, induction and repression, positive and negative regulation.
Week 12 (October 9-14)	Complement system: Structure, components, properties and functions. Operon model- lac, ara, trp, catabolite repression, transcription attenuation.
Week 13 (October 16 - 21)	Major Histocompatibility Complex- Class I and Class II MHC molecules, functions of MHC. Molecular mechanisms of DNA recombination in eukaryotes – Site Specific and Homologous recombination.
Week 14 (October 23-31)	Hypersensitivity and allergic reactions. (Brief only) Autoimmunity, immunological tolerance. Vaccines: concept, types of vaccines- Inactivated, Attenuated and Recombinant vaccines (Peptide and DNA vaccines). Recombination in prokaryotes – Transformation, transduction and conjugation.

Week 15 (November 2-9)	Sessional Exams
Week 16 (November 10-16)	Diwali Break
November 17	Sessional MDC
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Week 17 (November 20-24)	Revision
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**Head**  
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# DYAL SINGH COLLEGE, KARNAL

## **Lesson Plan (2023-24) EVEN Semester**

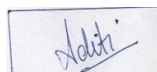
**Class: B.Sc. med. 4<sup>th</sup> sem**

**Subject: Biotechnology**

Week 1 ( January 1-6)	Recombinant DNA Technology and Genetic Engineering: Introduction, history, scope and applications. History, scope and importance of bioinformatics.
Week 2 ( January 8-13)	Tools of Recombinant DNA technology: Steps in gene cloning. Gene cloning tools – Restriction enzymes- class I, II and class III restriction enzymes, their features. Ligases, polymerases, alkaline phosphatases, kinases, transferases and other DNA engineering enzymes. Introduction to Genomics – information flow in Biology, DNA sequence data, experimental approach to genome sequence data, genome information resources.
Week 3 ( January 15-20)	Gene Cloning Vectors: Introduction, nomenclature of vectors, properties of a suitable vector. Plasmid vectors, bacteriophage, cosmids and phagemids. Properties of host. M13 vectors. Functional Proteomics – protein sequence and structural data, protein information resources and secondary data bases.
Week 4 ( January 22-27)	Expression vectors, shuttle vectors. Vectors for cloning in eukaryotic cells, YACs and BACs. Computational Genomics - Internet basics, biological data analysis and application,
Week 5 (January 29-February 3)	In vitro construction of r-DNA molecules: Isolation of gene of interest and vector DNA, cohesive and blunt ends, modification of cut ends, linkers and adaptors. Integration of DNA inserts into the vectors. Sequence data bases, NCBI model, File format
Week 6 ( February 5-10)	Transformation: Techniques of introducing r-DNA into the desired host, competent cells, electroporation and microinjection Sequence alignment and data base search – protein primary sequence analysis,
Week 7 ( February 12-17)	Screening and selection of transformants and their characterization, selection of clone having the specific DNA insert - immunological screening and colony hybridization. Marker genes- selectable and scorable markers. Algorithm BLAST
Week 8 ( February 19-23)	Gene Libraries: Construction of Genomic and cDNA library, advantages and limitations, screening of gene libraries. Multiple sequence alignment.
Week 9 ( February 26 March 2)	DNA amplification through PCR: Basic features and applications of PCR, types and modifications. Site directed mutagenesis. DATA base searching using BLAST and FASTA.
Week 10 (March 4-9)	DNA sequencing techniques: Maxam – Gilbert’s method, Sanger’s dideoxy chain termination method, Automated



	DNA sequencing. Predictive methods using DNA sequences
Week 11 (March 11-16)	Genome Mapping: Concept and applications. Restriction enzyme digestion and restriction mapping. Southern and Northern analysis. DNA finger printing. PAGE, Western blotting, dot blots and slot blots. RFLP, RAPD (brief only), microarrays. Predictive methods using protein sequences
Week 12 (March 18-22)	Gene expression in prokaryotes: expression cassette. Promoters- tissue specific promoters, wound inducible promoters, strong and regulated promoters.
Week 13 ( March 23-31)	Holi Break
Week 14 (April 1-6)	Increasing protein yield-factors affecting level of recombinant protein production. Production of recombinant proteins in E. coli, translational and transcriptional fusion- advantages and disadvantages. Structural data bases – Small molecules data bases, protein information resources,
Week 15 (April 8-13)	Applications of Recombinant DNA technology: Production of recombinant proteins of pharmaceutical importance- insulin, human growth hormone, recombinant vaccines (hepatitis B) etc. Transgenic plants and animals, protein data bank
Week 16 (April 15-20)	Revision
Week 17 (April 22- 30)	Revision



**Head**  
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# DYAL SINGH COLLEGE, KARNAL

## Lesson Plan (2023-24) ODD Semester

Class: B.Sc. Med. 5<sup>th</sup> Sem

Subject: Biotechnology

Week 1 ( July 24-29)	-----
Week 2 ( August 1-5)	<p><b>Animal Cell &amp; Tissue Culture:</b> Introduction, Principles &amp; practice. History and Development of animal cell culture. Scope and Applications. <b>Plant Tissue Culture:</b> Introduction/Concept, History, Scope and Applications along with major achievements.</p> <p>Plant Tissue Culture Laboratory: Layout and organization, different work areas, infrastructure/equipments and instruments and other requirements.</p>
Week 3 ( August 7-12)	<p>Culture Media: Media components, Serum containing and serum free media. Natural media- Plasma clot, biological fluids, tissue extracts. Growth factors required for proliferation of animal cells. Chemically defined media, balanced salt solutions. Physical requirements for growing animal cells in culture. Washing, drying, sterilization practices, various instruments and their uses in animal cell culture practices. Aseptic Techniques: General sanitation/cleanliness of PTC laboratory and precautions regarding maintenance of aseptic conditions, Washing, drying and sterilization of glassware, sterilization of media, surface sterilization, aseptic work station.</p> <p>Culture Media: Nutritional requirements for plant tissue culture, role of different media components, plant growth regulators, different culture media viz. MS, B<sub>5</sub> Nitsch and White's medium, Preparation of culture media.</p>
Week 4 ( August 14-18)	<p>Primary Cell Culture techniques: Initiation of cell culture-substrates (glass, plastic, metals) their preparation and sterilization. Isolation of tissue explants, disaggregation-enzyme disaggregation and mechanical disaggregation of the tissue. Development of primary culture and cell lines. In-vitro methods in plant tissue culture: Explants, their cellular characteristics, dedifferentiation and redifferentiation, cellular totipotency, organogenesis and somatic embryogenesis.</p>
Week 5 ( August 21-26)	<p>Subculture. Contamination.. Suspension culture, Growth curve of animal cells in culture. Micropropagation/clonal propagation of elite species (different routes of multiplication-axillary bud proliferation, somatic embryogenesis, organogenesis), Synthetic seeds (a brief account)</p>
Week 6 ( August 28-September 2)	<p>Secondary cell culture – transformed cell and continuous cell lines Finite and infinite cell lines.</p> <p>Cell lines: Insect and animal cells. Commonly used cell</p>

	lines- their organization and characteristics. Cell repositories and their function, Callus and suspension culture techniques: Introduction, principle, methodology, applications and limitations. Somaclonal variation. Organ culture: Anther & Pollen culture, ovary, ovule, embryo and endosperm culture – concept, technique, applications and limitations. Embryo rescue.
Week 7 (September 4 -9)	Karyotyping, biochemical and genetic characterization of cell lines. Protoplast culture: Protoplast isolation, viability test, protoplast culture. Somatic hybridization – protoplast fusion techniques (chemical and electro-fusion), selection of hybrids, production of symmetric and asymmetric hybrids and cybrids. Practical applications of somatic hybridization and cybridization.
Week 8 (September 11 -16)	Organ Culture: technique, advantages, applications and limitations. Artificial skin. Production of secondary metabolites in vitro: introduction, technique and utilities
Week 9 (September 18 -22)	Transfection of animal cells: transfection methods. Methods for cell fusion, Selectable markers, HAT selection and Antibiotic resistance. Biotransformation (a brief account only). Plant germ plasm conservation and cryopreservation
Week 10 (September 25 -30)	Cloning and expression of foreign genes in animal cells: Expression vectors. Over production and preparation of the final product i.e. expressed proteins. <b>Genetic Engineering in plants:</b> Introduction, Plant transformation by <i>Agrobacterium tumefaciens</i> and <i>A. rhizogenes</i> . Ti plasmid. Strategies for gene transfer to plant cells.
Week 11 (October 3-7)	Production of vaccines in animal cells. Hybridoma Technology: Production of monoclonal antibodies and their applications. Binary and cointegrate vectors. Gene targeting in plants. Use of plant viruses as vectors (brief account only).
Week 12 (October 9-14)	Embryo transfer technology- technique, its applications. Artificial insemination. Animal clones. Direct DNA transfer/Physical methods of gene transfer in plants - micro projectile bombardment, electroporation, liposome mediated, Calcium phosphate mediated etc.
Week 13 (October 16 - 21)	Transgenic Animals: transgenic sheep, cow, pig, goat etc Production of transgenic mice, ES cells can be used for gene targeting in mice, applications of gene targeting. Transgenic Plants: Introduction and applications. Developing insect resistance, bacterial and fungal disease resistance, virus resistance and abiotic stress tolerance in plants
Week 14 (October 23-31)	Therapeutic products through genetic engineering – blood proteins, insulin, growth hormone etc., Improving food quality – nutritional enhancement of plants (carbohydrates, seed storage proteins and vitamins). Plants as Bioreactors: antibodies, polymers, industrial

	enzymes.
Week 15 (November 2-9)	Sessional Exams
Week 16 (November 10-16)	Diwali Break
November 17	Sessional MDC
November 18	Revision / Distribution of sessional exams answer sheets
Week 17 (November 20-24)	Gene Therapy: introduction, types of gene therapy, vectors in gene therapy, major achievements, problems and prospects., Edible vaccines
Week 18 (November 28-December 2)	Revision



**Head**  
**Department of Biotechnology**

# DYAL SINGH COLLEGE, KARNAL

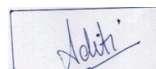
## **Lesson Plan (2023-24) EVEN Semester**

**Class: B.Sc. Med. 6<sup>th</sup> Sem**

**Subject: Biotechnology**

Week 1 ( January 1-6)	Microbial Biotechnology: Historical landmarks, General concept.
Week 2 ( January 8-13)	Screening and Isolation of Micro organisms: Industrially important microbes, their screening and isolation, enrichment culture.
Week 3 ( January 15-20)	Strain improvement- bacterial genetics, mutant selection, recombination, recombinant DNA technology. Strain preservation and maintenance.
Week 4 ( January 22-27)	Nutrition and cultivation of microorganisms: Basic nutrition and metabolism, Natural and Synthetic media,
Week 5 (January 29-February 3)	Sterilization techniques, Microbial growth kinetics. Fermentation types – Continuous, Batch fed culture, Solid state and Submerged.
Week 6 ( February 5-10)	Quantification of growth, thermodynamics of growth, effect of different factors on growth. Fermentation concepts and types.
Week 7 ( February 12-17)	Microbial Fermenters/Bioreactors: Basic design of fermenters. Physico-chemical standards used in bioreactors (agitation, aeration, ph, temp., dissolved oxygen etc.). Types of fermenters stirred tank, bubble column, airlift etc.
Week 8 ( February 19-23)	Process Development and Downstream Processing: Shake flask fermentation, scale up of the process.
Week 9 ( February 26 March 2)	Downstream processing – Separation of particles, disintegration of cells, extraction, concentration, purification and drying of the products
Week 10 (March 4-9)	Microbial Products: a brief discussion about production of certain industrial products such as –Alcohol, Alcoholic beverage (Beer), Organic acids ( citric acid), Antibiotics (penicillin), Amino acids (glutamic acid, Vitamin (B12), enzymes (protease, alpha-amylase) and a brief account of Steroid Biotransformation. Microbial Foods: Single Cell Proteins.
Week 11 (March 11-16)	Sewage waste water treatment technique and plants. Biodegradation of xenobiotic compounds. Microbial polysaccharides and polyesters; production of xanthan gum and polyhydroxyalkanoides (PHA). Bioconversions – Biomining and bioleaching. Biogas production.
Week 12 (March 18-22)	Revision

Week 13 ( March 23-31)	Holi Break
Week 14 (April 1-6)	Microbial technology in agriculture- Bioinsecticides, bioherbicides, biocontrol agents for disease control, advantages over chemical methods. Biofertilizers.
Week 15 (April 8-13)	Genetically engineered microbes: concept and technique; use of GEM in Agriculture, Industry and Medicine.
Week 16 (April 15-20)	Revision
Week 17 (April 22- 30)	Revision



**Head**  
**Department of Biotechnology**