

Maharaja Ranjit Singh College of Professional Sciences, Indore**Department of Biosciences**

Lesson Plan - B. Sc. Year I Sem I Biotechnology (July 2016 - Dec 2016)

Subject - Biochemistry and Analytical Techniques

BT+CS+Chem, BT+LS+Chem

Teacher - Dr. Mukesh Patidar

Day/ Lecture	Unit	Topic
1	I	Carbohydrates: Introduction and Biological importance, Aldoses-Ketoses
2		Concept of reducing and non-reducing sugars, Structure and properties of reducing sugars
3		Isomerism in monosaccharides- Optical isomers, stereoisomers, D and L forms
4		Epimers, Anomers, Mutarotation-open and ring structures
5		Disaccharides-Maltose, Lactose, Sucrose, Oligosaccharides-Raffinose
6		Polysaccharides-Starch, Amylose, Amylopectin, Glycogen,
7		Polysaccharides- Peptidoglycan, Cellulose, Proteoglycan matrix
8		Lipids- Introduction, Classes, Fatty acids-saturated, unsaturated, branched, essential fatty acids
9		Physical and chemical properties of lipids, Saponification value
10		Acid value, Iodine number, Rancidity
11		Structure and functions of Phospholipids and Sphingolipids
12		Structure and functions of Lipoproteins and Cholesterol
13	II	Amino acids-Structural and nutritional classification
14		Amino acids-Structural and nutritional classification
15		Properties of amino acids, Acid base behaviour
16		Properties of amino acids, Acid base behaviour
17		Zwitterions, Isoelectric pH
18		Color reactions of amino acids
19		Protein structure- Peptide bond, outline of primary, secondary, tertiary and quaternary structures with examples
20		Forces stabilizing secondary, tertiary and quaternary structures with examples
21		Forces stabilizing secondary, tertiary and quaternary structures with examples
22		Structural and functional proteins
23	III	Enzymes-Outlines of enzyme classification
24		Active-site, energy of activation, Transition-state hypothesis
25		Lock and Key hypothesis, Induced-fit hypothesis
26		Concept of Km, Michaelis-Menten equation
27		Enzyme activation, Various types of enzyme inhibitions
28		Enzyme inhibition and identification using double reciprocal plots
29		Introduction to Allosteric enzymes, Definition of holoenzyme
30		Definitions of Apoenzyme, coenzyme, prosthetic group and their examples
31		Concept of Ribozyme, Multiple forms, Isozymes and Abzymes
32		Chemical composition of nucleotides
33		Watson-Crick model of DNA structure, Types of DNA- A, B and Z DNA, their structure and occurrence

34		Types of RNA-rRNA, tRNA, mRNA and hnRNA
35	IV	Light microscopy-Bright field, Dark field microscopy
36		Light microscopy- Fluorescence microscopy and Phase contrast microscopy
37		Electron microscopy-SEM and TEM
38		Electron microscopy-SEM and TEM
39		Colorimetry and U.V.-Visible Spectrophotometry
40		Colorimetry and U.V.-Visible Spectrophotometry
41		Electrophoretic techniques and applications-Native and Denaturing PAGE
42		Agarose gel electrophoresis
43	V	Concept, types and applications of Chromatography-Paper chromatography
44		Paper chromatography
45		Thin-layer chromatography
46		Thin-layer chromatography
47		Gel-filtration chromatography
48		Ion-exchange chromatography
49		Ion-exchange chromatography
50		Affinity chromatography

Maharaja Ranjit Singh College of Professional Sciences, Indore	
Department of Biosciences	
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Subject - Biochemistry and Analytical Techniques	
BT+CS+Chem, BT+LS+Chem	
Teacher - Dr. Mukesh Patidar	
Day/Lecture	Topic
1	Principle, working knowledge of instruments like Colorimeter, pH meter, Centrifuge, Spectrophotometer, Microscope, Laminar Air Flow
2	Principle, working knowledge of instruments like Colorimeter, pH meter, Centrifuge, Spectrophotometer, Microscope, Laminar Air Flow
3	Qualitative analysis of Carbohydrates, Proteins and Lipids
4	Quantitative estimation of Protein by Folin-Lowry unitary method
5	Quantitative estimation of Protein by Folin-Lowry unitary method
6	Quantitative estimation of sugar by Nelson Somogyi's unitary method
7	Quantitative estimation of sugar by Nelson Somogyi's unitary method
8	Analyzing the enzyme activity
9	Study the effect of pH on enzyme activity
10	Study the effect of temperature on enzyme activity
11	Separation of amino acids by TLC
12	Separation of leaf pigments by Paper chromatography
13	Isolation of potato starch and observation under microscope

Maharaja Ranjit Singh College of Professional Sciences, Indore

Department of Biosciences

Lesson Plan - B. Sc. Year I Sem II Biotechnology (Jan 2017 - June 2017)

Subject - Cell Biology and Metabolism

BT+CS+Chem, BT+LS+Chem

Teacher - Dr. Mukesh Patidar and Prof. Zahabiya Saifee

Day/Lecture	Unit	Topic
1	I	Cell Theory- Prokaryotic and Eukaryotic cells, Structure of Prokaryotic cell
2		Structure of Eubacteria and Archaeobacteria
3		Size, shape and arrangement of bacterial cells, Gram positive and Gram negative cells
4		Eukaryotic cell structure, Plant cells, animal cells
5		Structure and difference from prokaryotic cell
6	II	Cell cycle and cell division- Mitosis
7		Meiosis
8		Anomalies in cell division and associated diseases
9		Cell synchrony, Cell-cell interactions
10		Cell signalling, Cell differentiation
11		Cell senescence and death
12	III	Structure and function of bacterial cell- Flagella, Pili, Cell wall
13		Structure and function of bacterial cell- Cytoplasmic membrane, Nuclear region, Mesosomes, Ribosomes
14		Structure and function of bacterial cell- Vacuoles, Metachromatic granules, Spores and Cysts
15		Structure and function of an eukaryotic cell- Cell wall, Cell membrane, Mitochondria
16		Structure and function of an eukaryotic cell- Chloroplast, Endoplasmic reticulum, Golgi bodies, Nucleus
17		Structure and function of an eukaryotic cell- Cytoskeleton, Microbodies, Centriole and Lysosome
18	IV	Carbohydrate metabolism- Aerobic and anaerobic glycolysis, Sequence of reactions in glycolysis
19		Regulation in glycolysis, Citric acid cycle (Amphibolic pathway)
20		Glycogenesis
21		Glycogenolysis
22		Pentose-Phosphate Pathway
23		Oxidative Phosphorylation etc.
24	V	Amino acid metabolism- Amino acid breakdown (transamination, deamination)
25		Amino acid breakdown- Urea cycle
26		Diseases associated with defects in amino acid metabolism
27		Lipid metabolism- Beta oxidation of saturated fatty acids
28		Oxidation of unsaturated fatty acids
29		Oxidation of odd-chain fatty acids, energy yield
30		Ketone bodies, diseases related to defects in lipid metabolism

Maharaja Ranjit Singh College of Professional Sciences, Indore		
Department of Biosciences		
Lesson Plan - B. Sc. Year I Sem II Biotechnology (Jan 2017 - June 2017)		
Subject - Cell Biology and Metabolism		
BT+CS+Chem, BT+LS+Chem		
Teacher - Prof. Zahabiya Saifee		
Day/Lecture	Unit	Topic
1		To study the plant cell structure using various plant material
2		To study microbial cell by Monochrome staining
3		To perform Gram staining
4		Study the different stages of mitosis and meiosis
5		Prepare slide for study of stomata
6		Study of permanent slides like cell division, prokaryotic and eukaryotic cells, Muscles and Nerve cells, T.S. of stomatal cells
7		Study of permanent slides like cell division, prokaryotic and eukaryotic cells, Muscles and Nerve cells, T.S. of stomatal cells
8		To study the animal cell structure using cheek cells.
9		Permanent slide preparation
10		Histochemical localization of lignin
11		Observe various stages of mitosis in onion root tip

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Lesson Plan - B. Sc. Year II Sem III Biotechnology (July 2016 - Dec 2016)

Subject - Molecular Biology

BT+CS+Chem, BT+LS+Chem

Teacher - Prof. Zahabiya Saifee

Day/Lecture	Unit	Topic
1	I	DNA And RNA-Chemical structure, Types and Properties
2		DNA And RNA-Chemical structure, Types and Properties
3		Experimental proof of DNA as genetic material
4		Experimental proof of DNA as genetic material
5		Genome-concept, Bacterial and viral genomes
6		Plant and Animal genome
7		Plant and Animal genome
8		DNA replication-Types
9		Experimental proof of semi-conservative replication, Replicon concept
10		Proteins and enzymes involved in replication in prokaryotes and eukaryotes
11		Proteins and enzymes involved in replication in prokaryotes and eukaryotes
12		Modes of DNA replication, Unidirectional and bidirectional replication
13		Types of DNA replication- Y-shaped, Theta mode, rolling circle replication
14		Types of DNA replication- Y-shaped, Theta mode, rolling circle replication
15	II	Eukaryotic chromosomal organization
16		Heterochromatin, Euchromatin
17		Chromatin structure-Nucleosomes
18		Chromatin structure-Nucleosomes
19		Histone and non-histone proteins
20		Histone modification
21		Histone modification
22		Introduction to Epigenetics
23		Introduction to Epigenetics
24	III	Central Dogma of Molecular Biology, Gene concept
25		Prokaryotic genes, Eukaryotic genes
26		Transcription
27		Transcription
28		Regulation of transcription in prokaryotes
29		Regulation of transcription in eukaryotes (Post transcriptional RNA processing)
30		Regulation of transcription in eukaryotes (Post transcriptional RNA processing)
31		Concept of mRNA and hnRNA, RNA processing
32		RNA processing, Splicing in eukaryotes
33		Translation in prokaryotes and eukaryotes
34	Translation in prokaryotes and eukaryotes	
35	IV	Regulation of gene expression in prokaryotes, Operon concept
36		Induction and repression, Catabolite repression
37		Operon models-Lac operon
38		Trp operon
39		Attenuation and enhancer elements
40		Insertion elements and transposons
41		Mutations-Silent, Point, frameshift
42		Transition, transversion, non-sense mutations
43		DNA damage and repair, UV damage, SOS repair
44		DNA damage and repair, UV damage, SOS repair
45	Genomic and Plasmid DNA isolation from bacteria	
46	Enzymes in restriction digestion and ligation	
47	Linkers, Introduction to vectors for DNA transfer	

48	V	Plasmid, Phage
49		Cosmid, Phagemid
50		BAC and YAC
51		Gene amplification-PCR
52		Concept of Gene mapping
53		Concept of Gene mapping

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Department of Biosciences	
Lesson Plan - B. Sc. Year II Sem III Biotechnology (July 2016 - Dec 2016)	
Subject - Molecular Biology	
BT+CS+Chem, BT+LS+Chem	
Teacher - Prof. Zahabiya Saifee	
Day/Lecture	Topic
1	Chromosomal DNA isolation from Plant cells
2	Chromosomal DNA isolation from Plant cells
3	Chromosomal DNA isolation from Animal cells
4	Chromosomal DNA isolation from Animal cells
5	Genomic DNA isolation from Micro-Organisms
6	Genomic DNA isolation from Micro-Organisms
7	Analysis of isolated DNA by Agarose gel electrophoresis
8	Spectrophotometric analysis of DNA and DNA melting
9	To study the effect of UV as a physical mutagen
10	To study the effect of UV as a physical mutagen
11	To study Gradient Plate Technique
12	To study Gradient Plate Technique

Maharaja Ranjit Singh College of Professional Sciences, Indore

Department of Biosciences

Lesson Plan - B. Sc. Year II Sem IV Biotechnology (Jan 2017 - June 2017)

Subject - Microbial Biotechnology

BT+CS+Chem, BT+LS+Chem

Teacher - Prof. Fatema Matkawala

Day/Lecture	Unit	Topic
1	I	Microbial classification - 3 Kingdom
2		Microbial classification - 5 Kingdom
3		Microbial classification - 3 domain
4		Bacterial Nutrition
5		Bacterial Nutrition
6		Nutritional classes of bacteria
7		Nutritional classes of bacteria
8		Microbial media and its types
9		Microbial media and its types
10		Methods of cultivation of microbes - aerobic
11		Methods of cultivation of microbes - aerobic
12		Methods of cultivation of microbes - anaerobic
13	II	Microbial growth
14		Mathematical expression of growth
15		Growth curve
16		Factors affecting growth
17		Batch culture
18		Continuous culture
19		Synchronous culture and diauxic growth
20		Quantification of microbial growth
21		Quantification of microbial growth
22		Physical control of microorganism
23		Chemical control of microorganism
24		Evaluation of chemical disinfectant- Tube dilution test
25		Evaluation of chemical disinfectant- diffusion test
26		Evaluation of chemical disinfectant- Phenol Coefficient
27	III	Fermentation Technology
28		Fermentation Technology
29		Primary and Secondary Screening
30		Primary and Secondary Screening
31		Strain Improvement
32		Inoculum Development
33		Industrial Sterilisation process
34		Scale-up and Harvest

35		Scale-up and Harvest
36		Recovery process
37		Recovery process
38	IV	Types of fermentation – batch
39		Types of fermentation – Continuous
40		Types of fermentation – Fed - batch
41		Submerged fermentation process
42		Solid State fermentation process
43		Basic design of a fermentor
44		Basic design of a fermentor
45		Factors affecting fermentor design
46		Types of fermentors- Fluidized, Packed Bed
47		Air lift Fermentor
48		Tray Fermentor
49		Tower Fermentor
50		V
51	Industrial Production of Penicillin	
52	Industrial Production of Cyanocobalamin	
53	Industrial Production of Glutamic Acid	
54	Industrial Production of Citric Acid	
55	Industrial Production of Amylase	
56	Industrial Production of Protease	

Maharaja Ranjit Singh College of Professional Sciences, Indore

Department of Biosciences

Lesson Plan - B. Sc. Year II Sem IV Biotechnology (Jan 2017 - June 2017)

Subject - Microbial Biotechnology

BT+CS+Chem, BT+LS+Chem

Teacher - Prof. Fatema Matkawala

Day/Lecture	Topic
1	Principles and working knowledge of instruments like Autoclave, Laminar Air Flow, Hot Air Oven, Colony Counter etc.
2	Principles and working knowledge of instruments like Autoclave, Laminar Air Flow, Hot Air Oven, Colony Counter etc.
3	Isolation of Micro-organism by Sector plate method
4	Isolation of Micro-organism by Sector plate method
5	Isolation of Micro-organism by Pour plate method
6	Isolation of Micro-organism by Pour plate method
7	Enumeration of bacteria by standard plate count method
8	Enumeration of bacteria by standard plate count method
9	Techniques for the Cultivation of Anaerobic Microorganisms
10	Techniques for the Cultivation of Anaerobic Microorganisms
11	Effect of temperature on microbial growth
12	Effect of temperature on microbial growth
13	Effect of pH on microbial growth
14	Effect of pH on microbial growth
15	Isolation of extremophiles
16	Isolation of extremophiles
17	Isolation of extremophiles
18	Primary Screening for antibiotic producing microorganisms
19	Primary Screening for antibiotic producing microorganisms
20	Primary Screening for amylase and protease producing microorganisms
21	Primary Screening for amylase and protease producing microorganisms

Maharaja Ranjit Singh College of Professional Sciences, Indore		
Department of Biosciences		
Lesson Plan - B. Sc. Year III Sem V Biotechnology (July 2016 - Dec 2016)		
Subject - Immunology and Animal Biotechnology		
BT+CS+Chem, BT+LS+Chem		
Teacher - Prof. Shradhha		
Day/Lecture	Unit	Topic
1	I	Immunity-Innate and acquired, Host defence mechanism- First, second and third lines of host defence
2		Infection and its type
3		Organs and cells of Immune system
4		Organs and cells of Immune system
5		Vaccines and their types
6		Antigens- Properties and types
7	II	Adjuvants, Immunoglobulins- structure, types and functions
8		Immunoglobulins-structure, types and functions
9		Generation of antibodies
10		Primary and secondary immune response
11		Agglutination and precipitation reactions
12		Hemagglutination, Immunofluorescence
13		ELISA, RIA
14		Coomb's test (Direct and indirect)
15		Latex agglutination
16		ODD and RID
17	III	History and development of cell culture
18		Equipments and materials for animal cell culture
19		Culture media for animal cell culture-BSS
20		Culture media for animal cell culture- Serun-containing and serum-free media
21		Growth factors- EGF, ECF, PDGF
22		Growth factors- IL-1, IL-2, NGF and Erythropoetin
23		Physical requirements of growing animal cells in culture
24	IV	Initiation of cell culture, Isolation and disaggregation of explants
25		Development of primary culture
26		Commonly used cell lines- their organizations and characteristics
27		Commonly used cell lines- their organizations and characteristics
28		Growth curve of animal cell cluture
29		Differentiation of cells
30		Organ culture- techniques, advantage and applications
31	Organ culture- techniques, advantage and applications	
32	V	Applications of animal biotechnology- Methods of transfection of animal cells
33		Applications of animal biotechnology- Methods of transfection of animal cells
34		Methods of cell fusion, selectable markers
35		HAT selection, Transgenic animals
36		Stem cell culture
37		Transplantation of cultured cells,
38		Bioreactors for large-scale production of animal cells

Maharaja Ranjit Singh College of Professional Sciences, Indore	
Department of Biosciences	
Lesson Plan - B. Sc. Year III Sem V Biotechnology (July 2016 - Dec 2016)	
Subject - Immunology & Animal Biotechnology	
BT+CS+Chem, BT+LS+Chem	
Teacher - Prof. Shradhha	
Day/Lecture	Topic
1	Determination of blood group
2	Total count of WBC
3	Total count of RBC
4	Differential count of WBC
5	Haemoglobin estimation by Sahli's method
6	To examine flocculation reaction using VDRL test
7	To observe the agglutination reaction using WIDAL test
8	Determine the concentration of unknown antigen using Radial Immuno Diffusion technique
9	Determine the concentration of unknown antigen using Radial Immuno Diffusion technique
10	To determine the antibody antigen reaction by performing ODD technique
11	To determine the antibody antigen reaction by performing ODD technique
12	Enzyme Linked Immuno Sorbent Assay

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Department of Biosciences

Lesson Plan - B. Sc. Year III Sem VI Biotechnology (Jan 2017 - June 2017)

Subject - Plant and Environmental Biotechnology

BT+CS+Chem, BT+LS+Chem

Teacher -

Day/Lecture	Unit	Topic
1	I	Introduction to and history of plant tissue culture
2		Introduction to and history of plant tissue culture
3		MS Media for plant tissue culture
4		Use of Growth regulators
5		Selection and maintenance of callus
6		Selection and maintenance of callus
7		Single cell culture
8		Single cell culture
9		Cytodifferentiation
10		Cytodifferentiation
11		Micropropagation
12		Micropropagation
13	II	Organogenesis
14		Somatic Embryogenesis
15		Somatic Embryogenesis
16		Synthetic Seed and its application
17		Haploid Plants- Anther and Ovary culture
18		Haploid Plants- Anther and Ovary culture
19		Haploid Plants- Anther and Ovary culture
20		Production of haploids and their uses
21		Production of haploids and their uses
22		<i>In vitro</i> pollination
23		<i>In vitro</i> fertilization
24	III	Protoplast isolation
25		Testing of viability
26		Regeneration of protoplast and protoplast fusion
27		Regeneration of protoplast and protoplast fusion
28		Markers for selection of hybrid cell
29		Practical applications of somatic hybridization
30		Introduction to Cybrids
31		Introduction to transgenic plants
32		Genetic manipulation of plants-use of <i>Agrobacterium tumifaciens</i>

33		Genetic manipulation of plants-use of <i>Agrobacterium rhizogenes</i>
34		Transfection methods
35		Advantages of Transgenic Plants
36	IV	Environment: Basic concept
37		Environment: Basic concept
38		Environment-Significance
39		Environment-Public awareness
40		Environmental pollution
41		Assessment of water and waste water quality
42		Treatment of waste-water – Primary
43		Secondary, advanced and final treatments
44		Solid waste management- composting
45		Solid waste management -vermiculture
46	Solid waste management - methane production	
47	V	Biopesticides- Bacterial and Fungal
48		Genetically modified crops containing insecticidal genes
49		Biofertilizers-Nitrogen fixers
50		PSB, Mycorrhiza and VAM
51		Microbial leaching of copper and uranium
52		Microbial Enhanced Oil Recovery
53		Bioremediation and Biodeterioration
54		Modern fuels-Methanogenic bacteria and biogas
55		Microbial hydrogen production
56		Gasohol experiment
57	Solar energy	

Maharaja Ranjit Singh College of Professional Sciences, Indore	
Department of Biosciences	
Lesson Plan - B. Sc. Year III Sem VI Biotechnology (Jan 2017 - June 2017)	
Subject - Plant and Environmental Biotechnology	
BT+CS+Chem, BT+LS+Chem	
Teacher -	
Day/Lecture	Topic
1	Introduction to plant tissue culture techniques
2	Media preparation and sterilization and methods of surface sterilization of explants
3	Media preparation and sterilization and methods of surface sterilization of explants
4	Seed germination in-vitro for aseptic collection of explants.
5	Micropropagation
6	Micropropagation
7	Callus induction from leaf, stem and roots
8	Callus induction from leaf, stem and roots
9	Organogenesis
10	Organogenesis
11	Somatic embryogenesis
12	Somatic embryogenesis
13	Preparation of synthetic seeds
14	Preparation of synthetic seeds
15	Suspension culture propagation and uses
16	Suspension culture propagation and uses
17	Protoplast isolation and culture
18	Protoplast isolation and culture
19	Demonstrate the enzymatic conversion of ammonia to nitrates by soil microorganisms
20	Quantitative and qualitative microbiological analysis of potable water and water
21	Quantitative and qualitative microbiological analysis of potable water and water
22	Quantitative and qualitative microbiological analysis of potable water and water
23	Microbiological analysis of soil
24	Microbiological analysis of soil
25	Isolation of Rhizobium from root nodules
26	Isolation of Rhizobium from root nodules
27	Isolation of Azotobacter from soil
28	Isolation of Azotobacter from soil
29	Measurement of BOD and COD and dissolved oxygen
30	Measurement of BOD and COD and dissolved oxygen
31	Measurement of total dissolved salts