

Integral University, Lucknow

Evaluation Scheme and Syllabus

for

M.Sc. (Biochemistry)

(Revised w.e.f. session 2015-2016)

Department of Biosciences

Department of Biosciences
Evaluation Scheme
M. Sc. Biochemistry Semester – I
Choice Based Credit System (CBCS)

Course Code	Course Title	Type of Paper	Periods/Week			Evaluation Scheme					Credits	Total Credit
			L	T	P	CT	TA	Total	ESE	Maximum Marks		
BS401	Biomolecules: Structure & Functions	Core	3	1	0	15	10	25	75	100	3:1:0	4
BS421	Bioinformatics and Applied Statistics	Core	3	1	0	15	10	25	75	100	3:1:0	4
BS403	Essentials of Molecular Biology	Core	3	1	0	15	10	25	75	100	3:1:0	4
BS404	Biophysical & Biochemical Methods	Core	3	1	0	15	10	25	75	100	3:1:0	4
BS 422	Essentials of Microbiology	Core	3	1	0	15	10	25	75	100	3:1:0	4
BS 423	Biochemistry & Microbiology lab	Practical	0	0	12	15	10	25	75	100	0:0:6	6
Total										600		26

Course	Course Code	Associated labs	ESE	Credits
Biochemistry & Microbiology	BS 423	Biochemistry lab.	50	3
		Microbiology lab.	50	3

M.Sc. Biochemistry Semester - II

Course Code	Course Title	Type of Paper	Periods/Week			Evaluation Scheme				Maximum Marks	Credits	Total Credit
			L	T	P	CT	TA	Total	ESE			
BS411	Gene Expression & Regulation	Core	3	1	0	15	10	25	75	100	3:1:0	4
BS412	Enzymology & Enzyme kinetics	Core	3	1	0	15	10	25	75	100	3:1:0	4
BS413	Metabolism & Bioengertics	Core	3	1	0	15	10	25	75	100	3:1:0	4
BS 431	Cytology & Cell Signalling	Core	3	1	0	15	10	25	75	100	3:1:0	4
Elective courses (Any one of the following)		<i>Elective</i>	3	1	0	15	10	25	75	100	3:1:0	4
BS415	Molecular Genetics											
BS416	Environmental Biology											
BS417	Pharmaceutical Biology											
BS432	Analytical Biochemistry and Enzymology Lab	Practical	0	0	12	15	10	25	75	100	0:0:6	6
BS419	Educational/Industrial tour									Satisfactory/Unsatisfactory		
Total										600		26

Course	Course Code	Associated labs	ESE	Credits
Biochemistry	BS 432	Analytical Biochemistry lab.	50	3
		Enzymology lab.	50	3

Note: The students of M.Sc. Biochemistry have to undergo the educational/Industrial tour in Biochemistry based industry/research institution for practical awareness at the end of 2nd semester.

Integral University, Lucknow
Department of Biosciences

M. Sc. (BC) 1st year

1st sem

Subject: Biomolecules: Structure & Functions

Subject Code: BS401

(Revised w.e.f. session 2015-2016)

L T P

3 1 0

UNIT I

8

Classification, characteristics and functions of simple carbohydrates; Structure and properties of mono, oligo and polysaccharides; Complex carbohydrates: Types, structure and general function; Chemistry of amino sugars, blood sugar compounds, sugar nucleotides

UNIT II

8

Fatty acids: General formula, nomenclature and chemical properties; Lipid classification: simple, complex; General structure and functions of major lipid subclasses - acyl glycerols, phosphoglycerides, sphingolipids, waxes, terpenes, steroids and prostaglandins & free fatty acids; Circulating lipids - chylomicrons. LDL, HDL and VLDL

UNIT III

8

Vitamins: Structure, properties, deficiency, symptoms and functions including biochemical reactions. Hormones: Structure, properties & functions of animal & plant hormones.

UNIT IV

8

Amino acids: Chemical structure and general properties; Protein classification, size, shape, sequence of proteins; Primary, secondary, tertiary and quaternary structure of proteins

UNIT V

8

Structure of purines, pyrimidines, nucleosides and nucleotides; Physical & biochemical properties of DNA; Types of DNA: A, B and Z DNA, their structure and significance; Physical & biochemical properties of RNA: tRNA, rRNA, mRNA and hnRNA; Primary, secondary, and tertiary structures of RNA

References

Lehninger, AL "Principles of Biochemistry"

Lubert Stryer "Biochemistry"

Voet & Voet "Biochemistry"

Baltimore "Molecular Cell Biology"

Robert K., M Murray, Daryl K. Granner, Peter A. Mayes, Victor W. Rodwell, Appleton & Lange, Robert K.

Murray "Harper's Biochemistry"

UNIT I

8

Computer basics; Operating systems; Software, DOS; Programming in Visual Basic: Introduction to application development using Visual Basic; Standard Controls; Data Access Using Data Control; Internet; LAN; WAN; Web servers; Introduction to Nucleic acid Sequence and protein Data Banks: SWISSPROT; Signal peptide data bank: Genbank.

UNIT II

8

Database Similarity Searches: BLAST, FASTA, PSI-BLAST, algorithms; Multiple sequence alignments - CLUSTAL, PRAS. Primer Designing; Homology Modeling; Phylogenetic analysis & Drug Designing; Determination of Secondary & Tertiary of proteins.

UNIT III

8

Handling of data: tabulation and diagrammatic representation of data – bar diagram and pie diagram. Measures of central tendency: mean, median and mode. Measures of dispersion: range, quartile deviation, mean deviation and standard deviation. Coefficient of variation.

UNIT IV

8

Tests of significance: Null hypothesis and alternative hypothesis, Z-test, Student's distribution, Paired t – test, F-test for equality of population variances. Contingency table, Chi-square test for goodness of fit and independence of attributes.

UNIT V

8

Correlation analysis: Positive and negative correlation, Karl person's coefficient of correlation, Spearsman's rank coefficient of correlation. Regression analysis: regression lines X on Y and Y on X.

References

O'Reilly "Developing Bioinformatics computer skills"

J.F. Griffiths "An intro to generic Analysis"

Lawrence hunter "Artificial Intelligence & molecular biology"

Andreas D. Baxevanis "Bioinformatics: A practical Guide to the analysis of genes and proteins"

Stephen A., Ph.D. Krawetz David D., Ph.D. Womble "Introduction to Bioinformatics: A Theoretical and Practical Approach"

Integral University, Lucknow
Department of Biosciences

M. Sc. (BC) 1st year

1st sem

Subject: Essentials of Molecular Biology

Subject Code: BS403

(Revised w.e.f. session 2015-2016)

L T P
3 1 0

UNIT I

8

Nucleic acid as genetic information carriers: Details of Griffith experiment, Avery, McLeod and McCarty experiment, Hershey and Chase experiment; Possible modes of replication: Details of Meselson and Stahl experiment; Prokaryotic DNA replication: Initiation, elongation and termination; Origin of replication; Roles, properties and mechanism of action of DnaA, Helicase, HD protein, Primase, DNA gyrase, Topoisomerase, DNA Polymerase, DNA ligase, Leading and lagging strands; Okazaki fragments; RNA primers; Regulation of replication; Fidelity of replication; σ or Rolling circle replication in ϕ X174.

UNIT II

8

Eukaryotic DNA replication: Initiation, elongation and termination; Multiple initiation sites; Autonomously replicating sequence; Significance of Origin recognition complex, Minichromosome maintenance proteins, DNA dependent DNA polymerases α , δ , ϵ , Nucleases, DNA ligase and Telomeres in eukaryotic nuclear DNA replication; Regulation of eukaryotic DNA replication; Mitochondrial and Chloroplastic DNA replication.

UNIT III

8

Transcription in prokaryotes: Outline of the process - Initiation, elongation and termination; Prokaryotic promoter; DNA dependent RNA polymerase (RNA polymerase): Physical properties, X-Ray crystallographic structure, Subunits, Types of σ subunit; Recognition of promoter; Binding and initiation sites; Melting of DNA; Direction of chain growth; Abortive initiations; Promoter clearance; Rho dependent and Rho independent termination of transcription; Sigma cycle; RNA - dependent DNA polymerase and Reverse transcription.

UNIT IV

8

Classes of DNA sequences: Unique DNA sequences, Repetitive DNA sequences; Zero time binding DNA; Reasons for generation of reiterative DNA sequences; Highly repetitive and Moderately repetitive DNA sequences; Direct and Inverted repeats; Genome - wide and Tandem repeats; Overview of repetitive DNA sequences: Pseudogenes, LINEs, SINEs, Retroelements, Transposable elements, rRNA, tRNA and Histone genes, Centromeres, Telomeres, Satellite DNA, Minisatellites, Microsatellites; Applications of satellite DNA. Methods of distinguishing or separating double stranded and single stranded DNA; C-value and C-value paradox; Split genes: Exons and Introns

UNIT V

8

Movable genes: transposons: Simple and Composite transposons, Mechanism of transposition, Example of transposons: Ds/ Ac family of transposon, Ty of yeast, Copia, P and FB element of Drosophila, LINEs and SINEs.

References

Lewin "Genes"

Freifelder, DM "Molecular Biology"

Brown, TA "Genomes"

Watson, JD "Molecular Biology of the cell"

Twyman, R.M. Advanced Molecular Biology”

Brown, TA”Gene cloning: An introduction”

Old & Primrose “Principles of Gene Manipulation”

Primrose, SB “Molecular Biotechnology”

Jose B. Cibelli, Robert P. Lanza, Keith Campbell, Michael D. West “Principles of Cloning”

Integral University, Lucknow
Department of Biosciences

M. Sc. (BC) 1st year

1st sem

Subject: Biophysical and Biochemical Methods

Subject Code: BS404

(Revised w.e.f. session 2015-2016)

	L T P
	3 1 0
UNIT I	8
Microscopy: Simple, compound, phase contrast, fluorescence, electron microscopy (TM, SM & STM) and confocal microscopy, fluorescent activated cell sorting (FACS), Freeze drying.	
UNIT II	8
Radiotracer technology: Use of radioactive isotopes in biological system, detection and measurement of isotopes, Geiger-Muller counter, Liquid scintillation counter, autoradiography, X-ray crystallography. Biosensors: Basic techniques, enzyme electrode, microbial biosensors.	
UNIT III	8
Centrifugation & Electrophoresis: Centrifugation: types of rotors, techniques and their applications: differential, zonal, density gradient and ultra centrifugation. Electrophoresis: Principle, techniques and applications: capillary electrophoresis, paper and gel electrophoresis (PAGE, Agarose, Pulse Field gel electrophoresis, 2D-PAGE), Isoelectric focusing, isotachopheresis, Protein Sequencing, N & C terminal, Edman degradation	
UNIT IV	8
Chromatography: Adsorption, paper, partition, ion-exchange, reverse phase, gel filtration, affinity, gas chromatography and HPLC and FPLC.	
UNIT V	8
Photometry: Theory, instrumentation and applications of visible photometry. Basic Principles of Spectroscopy: UV & Visible, atomic absorption, nuclear magnetic resonance, mass spectrometry, CD, ORD.	

References

Keith Wilson John Walker John M. Walker "Principles and Techniques of Practical Biochemistry"
Joseph Sambrook David W. Russell Joe Sambrook "Molecular Cloning: A Laboratory Manual"
William M., Ph, D. O'Leary Robert Dony Wu "Practical Handbook of Microbiology"
Brown, TA "Gene cloning: An introduction"

(Revised w.e.f. session 2015-2016)

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UNIT I

8

Characterization and classification of microorganisms. Morphology and structure of bacteria, gram positive and gram negative bacteria, cultivation of bacteria, nutrition, physiology and growth of microbial cells. Reproduction and growth, synchronous growth, continuous culture of microorganisms. Pure cultures and cultural characteristics. Genetic recombination in bacteria, conjugation, transformation and transduction.

UNIT II

8

Structure of fungus: yeast and mold. Fundamentals of control of microbial growth, control by physical and chemical agents. Production of mutants by chemical and physical agents and their characterizations.

UNIT III

8

Bacterial toxins – Classification, structure and mode of action of bacterial protein toxins. Host Microbe Interactions. Viruses of bacteria, plant and animal cells, structure classification life cycle, Mycoplasma and virioids, diseases Viruses – General structure, properties and classification.

UNIT IV

8

Media for Industrial Fermentation: Substrates for bioconversion processes, preparation, sterilization, design. Large scale production and commercial applications of enzymes: proteases and amylases.

UNIT V

8

Large scale production and commercial applications of solvents and antibiotics: acetic acid, ethanol, acetobutanol, penicillin and streptomycin.

Texts/References:

Pelczar MJ Jr.; Chan ECS and Kreig NR.; Microbiology; 5th Edition; Tata McGraw Hill; 1993.

Maloy SR; Cronan JE Jr.; and Freifelder D; Microbial Genetics; Jones Bartlett Publishers; Sudbury; Massachusetts; 2006.

Crueger and A Crueger; (English Ed.; TDW Brock); Biotechnology: A textbook of Industrial Microbiology; Sinaeur Associates; 1990.

G Reed; Prescott and Dunn's; Industrial Microbiology; 4th Edition; CBS Publishers; 1987.M.T. Madigan and J.M. Martinko; Biology of Microorganisms; 11th Edition; Pearson Prentice Hall; USA; 2006.

PRACTICALS

BS 423: Biochemistry & Microbiology lab

L T P
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1. Preparation of buffers and measurement of pH.
2. Qualitative tests of carbohydrates: Molish's Test, Fehling's Test; Benedict's Test; Barfoed's Test; Phenyl Hydrazine Test; Seliwanoff's Test; mucic acid Test, bial's test; Iodine Test, Nelson-Somogyi Method.
3. Qualitative tests of proteins & Amino Acids: Millon's test, Biuret test; Ninhydrin Test; Xanthoproteic Test; Hopkin's Cole Test.
4. Comparative evaluation of different methods of protein analysis: UV, Lowry, Biuret, Bradford.
5. Determination of Calcium (Ca) and inorganic phosphorus (P).
6. Isolation and estimation of Glycogen.
7. Methods of sterilization and preparation of various culture media.
8. Purification techniques: Serial dilution, pour plate and streak plate method.
9. Identification of isolated bacteria: Gram staining other staining methods, metabolic characterization.
10. Growth curve of microorganisms

References:

Keith Wilson John Walker, John M. Walker "Principles and Techniques of Practical Biochemistry"
Chirikjian "Biotechnology Theory & Techniques"
Joseph Sambrook, David W. Russel, Joe Sambrook "Molecular Cloning: A Laboratory Manual"
William M, O'Leary Robert, Dony Wu "Practical Handbook of Microbiology"
Sadasivam "Biochemical methods"
Plumer "Practicals"

(Revised w.e.f. session 2015-2016)

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UNIT I

8

Transcription in eukaryotes: Synthesis of pre-mRNA: Outline of process - Initiation, elongation and termination, RNA Pol II promoter, Enhancer elements, Subunit structure of RNA Pol II, Roles of RNA polymerase II, Transcription factors, Nucleosome modifiers, Mediator complexes, Chromatin remodellers, Elongation factors in transcription; Cleavage and polyadenylation; Synthesis of pre-rRNA and pre-tRNA: Outline of process, RNA Pol I and III promoters sequences, RNA Pol I and III; DNA-binding motifs: Helix-turn-Helix, Zinc Finger, Leucine-Zipper, Homeodomain.

UNIT II

8

Post - transcriptional / Cotranscriptional processing (Maturation of precursors of rRNA, mRNA, tRNA): End modifications (Addition of 5' cap and 3' Poly A tail in mRNA), RNA splicing - Self splicing and Spliceosome mediated splicing, Cutting events or action of ribonucleases, Covalent modifications, RNA editing, Alternative splicing.

UNIT III

8

Translation in prokaryotes and eukaryotes: Outline of the process - Initiation, elongation and termination; Adapter role of tRNA, Evidences for a triplet code; Properties of Genetic code; Ubiquitous code and deviations; Synonymous codons; Codon family and Codon pairs; Nonsense and Sense codons; Degeneracy: Significance of Isoacceptor tRNAs and Wobble hypothesis; Codon bias; Amino acyl tRNA synthetase: Classification, Specificity, Reaction catalyzed; A, P and E sites of ribosome; Start and stop codons, Ribosome binding site; Formation of initiation complex; Transpeptidation and Translocation; Ribosome cycle; Roles of Initiation factors, Elongation factors, Release factors, Aminoacyl tRNA synthetase, tRNA, rRNA, GTP, Peptidyl transferase site and Factor binding site of ribosomes in translation.

UNIT IV

8

Post - translational processing: Basics of Protein folding, Intein splicing, Chemical modification, Proteolytic cleavage, Zymogen activation; Polycistronic and monocistronic.

UNIT V

8

Regulation of gene expression; Concept of operon: Lac, Trp and Ara operons, Significance of repressor, Attenuation; Inhibitors of transcription and translation.

References

Lewin "Genes".

Freifelder, DM "Molecular Biology"

Brown, TA "Genomes"

Watson, JD "Molecular Biology of the cell"

Twyman, RM "Advanced Molecular Biology"

Brown, TA "Gene cloning: An introduction"

Old & Primrose "Principles of Gene Manipulation"

Primrose, SB "Molecular Biotechnology"

Jose B. Cibelli Robert P. Lanza Keith Cambell Michasel D. West "Principles of Cloning"

Voet & Voet "Biochemistry"; Lubert Stryer "Biochemistry"

Integral University, Lucknow
Department of Biosciences

M. Sc. (BC) 1st year

2nd sem

Subject: Enzymology & Enzyme Kinetics

Subject Code: BS412

(Revised w.e.f. session 2015-2016)

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UNIT I

8

Classification and nomenclature of enzymes. General properties of enzymes. Mechanism of enzyme action: Chymotrypsin, ribonuclease, activation of transition metal cation, activation by alkaline earth metal cation, nicotinamide nucleotide, flavin nucleotide and adenosine phosphate.

UNIT II

8

Michaelis-Menten initial rate equation based on equilibrium assumption, Briggs-Haldane steady state approach, integrated form of the Michaelis equation, methods for the determination of K_m and V_{max} normalized initial rate equation and normalized curves, Haldane relationship.

UNIT III

8

Effect of enzymes concentration, pH and temperature on kinetics of enzyme reactions. Enzyme inhibition and activation: Types of reversible inhibitors, qualitative analysis of data, derivation of equations for different types of inhibitions, determination of inhibitor constant, determination of activator constant.

UNIT IV

8

Multisubstrate enzyme kinetics: random bi-bi, and ping pong reactions. Intracellular localization of enzymes, purification of enzymes and tests for homogeneity.

UNIT V

8

Immobilization; kinetics of immobilized systems. Isozymes. Allosteric enzymes. Industrial and clinical scope of enzymes.

References

Lehninger, AL "Principles of Biochemistry"
Lubert Stryer "Biochemistry"
Voet & Voet "Biochemistry"
Shuler "Bioprocess Engineering"
Alan Fersht "Enzyme Structure and Mechanism"
David S. Sigman, Paul S. Sigman "The Enzymes: Mechanisms of Catalysis"
Palmer "Enzymes"
Dixon & Webb "Enzymes"

Integral University, Lucknow
Department of Biosciences

M. Sc. (BC) 1st year

2nd sem

Subject: Metabolism & Bioenergetics

Subject Code: BS413

(Revised w.e.f. session 2015-2016)

	L T P
	3 1 0
UNIT I	8
Carbohydrate metabolism: Glycolytic pathway and Non- glycolytic pathways, Hexose monophosphate pathway, Tricarboxylic acid cycle. Anaplerotic sequences in metabolism, glycogenolysis, Krebs- Kornberg pathway, Glyoxylate pathway. Glucose catabolism in cancerous tissue, Energy production by aerobic and anaerobic respiration: Electron transport chain, oxidative phosphorylation.	
UNIT II	8
Biosynthesis of carbohydrates: Gluconeogenesis, glycogen synthesis, reductive pentose phosphate pathway, carbon dioxide assimilation in C3 and C4 plants.	
UNIT III	8
Lipid biosynthesis: synthesis of saturated and unsaturated fatty acids, biosynthesis of triacylglycerols glycerophospholipids and membrane phospholipids, plasmalogens, sphingolipids, cholesterol.	
UNIT IV	8
Degradation of fatty acids: α , β , ω oxidation; Ketone bodies, acidosis, ketosis, Cholesterol degradation.	
UNIT V	8
Biosynthesis of purines and pyrimidines, degradation of nucleosides, nucleotides and nucleic acids, Salvage pathways. Biosynthesis and biodegradation of amino acids. Inborn errors of metabolism.	

References

Lehninger AL "Principles of Biochemistry"

Lubert Stryer "Biochemistry"

Voet & Voet "Biochemistry"

Shuler "Bioprocess Engineering"

Alan Fersht "Enzyme Structure and Mechanism".

David S. Sigman Paul S. Sigman "The Enzymes: Mechanisms of Catalysis".

UNIT I

8

Cell classification, cell variability (size, shape, complexity, functions). Structural organization of prokaryotic and eukaryotic cells. The ultra structure and functions of cell wall, nucleus, mitochondria, chloroplast, endoplasmic reticulum, microsomes, Golgi apparatus, lysosomes & peroxisomes.

UNIT II

8

The cytoskeleton – microtubules and microfilaments. Structure and functions of cell membrane, Transport across cell membrane: Diffusion, Facilitated diffusion, Active transport; transport proteins, exocytosis, receptor mediated endocytosis, osmoregulation.

UNIT III

8

Cell division: mitosis and meiosis; Cell cycle: check points, role of cyclin and cyclin dependent kinases in its regulation.

UNIT IV

8

Cell- Extracellular matrix interactions: Plasmodesmata, Gap junction, Tight junction, Adherens, Cohesin, Elastin, Collagen, Fibronectins, Laminins, Integrins; Basics of signal transduction: Role of calcium, Camp, G-protein, inositol phosphates, phospholipases and protein kinases in signal transduction.

UNIT V

8

Protein traffic in cells: Protein sorting and signal sequences; protein translocation in ER and vesicular transport to Golgi, lysosomes and plasma membrane; protein import into nuclei, mitochondria, chloroplasts and peroxisomes.

References

Moo –Young “Comprehensive Biotechnology”

Cruger & Cruger “Biotechnology: A text book of Industrial Microbiology”

Prescott & Dunn “Industrial Microbiology”

Bruce L. McCarty “Environmental Biotechnology: Principles and Applications”

Integral University, Lucknow
Department of Biosciences

M. Sc. (BC) 1st year

2nd sem

Subject: Molecular Genetics

Subject Code: BS415

(Revised w.e.f. session 2015-2016)

UNIT I

8

Genome organization and DNA packaging; Nuclear decondensation (in both prokaryotes and eukaryotes); Chromosome structure and function; Numerical and structural changes in chromosomes; Cytogenetics: chromosome aberration.

UNIT II

8

Genetic Control of Development in *C. elegans*, *Drosophila*, *Neurospora crassa*, *Arabidopsis thaliana*.

UNIT III

8

Principles of Mendelian inheritance, Linkage and genetic mapping; Extrachromosomal inheritance, Sex-linked inheritance and genetic disorders, Somatic cell genetics, Population genetics.

UNIT IV

8

Physical and Chemical Mutagens, Drug metabolism and detoxification; DNA damage: Types of mutations, DNA repair mechanisms: Y-family DNA Polymerases; Micronuclei; FISH; COMET-Assay. Etiology of cancer: Oncogenes; proto-oncogenes; Viral and cellular oncogenes; tumour suppressor genes from humans; Structure; function and mechanism of action of pRb and p53 tumour suppressor proteins.

UNIT V

8

The Human Genome Project; gene therapy, integration of DNA into mammalian genome, Expression of foreign genes in transgenic animals, Genetic Testing-DNA Fingerprinting; Genetic Diversity - Conservation Genetics; Legal and Ethical Issues in Genetics; Genetic Counseling.

References

Gardener "Principles of Genetics"

Tom Strachan, T. Strachan, Andrew Read, Andrew P. Read "Human Molecular Genetics"

William S. Klug Michael R. Cummings "Concepts of Genetics (7th Edition)"

Ricki Lewis "Human Genetics: Concepts and Applications"

Leland Hartwell Leroy Hood Michael L. Goldberg Ann E. Reynolds Lee M. Silver Ruth C. Veres Ricki

Lewis "Genetics: From Genes to Genomes"

Debra Davis "Animal Biotechnology: Science-Based Concerns"

Anthony Atala, Robert P. Lanza "Methods of Tissue Engineering"

Nigel Jenkins "Animal Cell Biotechnology: Methods and Protocols"

Carl Pinkert "Transgenic Animal Technology: A Laboratory Handbook"

Integral University, Lucknow
Department of Biosciences

M. Sc. (BC) 1st year

2nd sem

Subject: ENVIRONMENTAL BIOLOGY

Subject Code: BS416

(Revised w.e.f. session 2015-2016)

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UNIT I

8

Microbiology of air and aquatic environments - Bacteriological indicators of pollution, Bacteriological examination of water, nuisance bacteria in water systems. Chemical and microbiological characteristics, Biological Oxygen Demand (BOD), Microorganisms and pollution problems and interaction with human bodies.

UNIT II

8

Environmental pollution: Definition, source and types of pollution (air, water and soil). Xenobiotic toxicity/genotoxicity, Mode of action of pesticides, fungicides and insecticides; Mutation detection by Ames, microsomal assay. Bioaccumulation and bioremediation, Biosensors, DNA probes and their environmental applications, Toxicogenomics.

UNIT III

8

Recycling of organic waste: Major sources of recyclable materials including agricultural waste. Key technology in recycling of crop residues, human and animal wastes. Composting and vermicomposting; Production and application. Role of microbes in composting and biogas production. Municipal solid waste treatment and management.

UNIT IV

8

Microbes of toxic environments: Microbial biotransformation/ degradation of organic pollutants in soil. Microbial degradation and persistence of xenobiotics, pesticides, herbicides, heavy metals and radio isotopic materials. Pesticides toxicity to microbes and plants. Acid mine drainage, coal desulphurization.

UNIT V

8

Biodeterioration-concept, biodeterioration of wood, stonework, pharmaceutical products, rubber, plastic, paints, lubricants, cosmetics, control of biodeterioration.

Reference Books:

- Environmental biotechnology (Industrial pollution Management).Jogdand S.N., Himalaya pub. house.
- Waste water treatment – Rao M.N. and A.K.Datta
- Industrial pollution Control, Vol. 1, E. Joe, Middle Brooks.
- The treatment of industrial wastes, 2nd Ed. Edmund D. Besseliere and Max Schwartz.
- Water and water pollution hand book, Vol. 1, Leonard L., Ciaccio
- Ec Eldowney S, Hardman DJ, Waite DJ, Waite S. (1993). Pollution: Ecology and Biotreatment Longman Scientific Technical.
- Grant WD, Long PL. (1981) Environmental Microbiology. Blackie Glasgow and London.
- Paul EA, Clark FF Soil Microbiology and Biochemistry, Academic Press, San Diego.
- Rogers JE and Writman WB (1991) Microbial production and consumption and green house gases: Methane: Nitrogen oxides and Halomethanes. ASM, Washington DC.

(Revised w.e.f. session 2015-2016)

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Unit I	3	1	0
Monoclonal antibodies: applications, generation, recombinant antibodies, production methods, Pharmaceutical, regulatory and commercial aspects.		8	
Unit II			8
Formulation of proteins and peptides: making small protein particles, precipitation of proteins, quality control issues, multi-phase drug delivery system; Preparation of collagen, gelatin particles, albumin microparticles.			
Unit III			8
Proteins and phospholipids: structural properties of phospholipids, injectable lipid emulsions, liposomes, cochlear phospholipids structures; Polymeric systems for oral protein and peptide delivery.			
Unit IV			8
Pulmonary drug delivery systems for biomacromolecules; Lipid based pulmonary delivery; Solid colloidal particles; Polycyanoacrylates; Poly (ether-anhydrides); Diketopiperazine derivatives; Poly ethylene glycol conjugates; Factors affecting pulmonary dosing.			
Unit V			8
Polymers used for controlled drug delivery: Hydrophobic polymers poly(esters), poly(cyanoacrylate), poly (ortho esters), poly (phosphazenes), Hydrophobic polymers poly (alkyl methacrylates), poly (methacrylates), poly (acrylates)], alginates, chitosan, polyethylene glycol. Gene therapy: the current viral and non-viral vectors.			

Books recommended:

1. Groves MJ 'Pharmaceutical Biotechnology', Taylor and Francis Group.
2. Crommelin DJA, Robert D, Sindelar 'Pharmaceutical Biotechnology'.
3. Kayser O, Muller R 'Pharmaceutical Biotechnology'.
4. Banga AK 'Therapeutic peptides and proteins'.

Integral University, Lucknow
Department of Biosciences

M. Sc. (BC) 1st year

2nd sem

Subject: Analytical Biochemistry and Enzymology Lab

Subject Code:BS 432

1. Amino acid detections (Paper chromatography/ TLC).
2. Estimation of starch in wheat flour and percentage recovery of starch.
3. Glucose estimation by Anthrone method, fructose estimation by resorcinol method in biological sample.
4. To find out isoelectric point of protein.
5. Separation of serum protein by Poly Acrylamide Gel Electrophoresis.
6. Assay of clinically important enzyme: serum Alkaline phosphatase (ALP), serum Creatine phosphokinase (CPK) & serum acid phosphatase.
7. Study of the effect of varying substrate concentration and pH on the enzyme activity and determination of Km.
8. Isolation and estimation of RNA.

References

Keith Wilson, John Walker, John Walker, John M. Walker "Principles and Techniques of Practical Biochemistry"
Chirikjian "Biotechnology Theory & Techniques"
Joseph Sambrook, David W. Russel, Joe Sambrook "Molecular Cloning: A Laboratory Manual"
William M, O'Leary Robert, Dony Wu "Practical Handbook of Microbiology"
Brown, TA "Gene cloning: An introduction"
Sadasivam "Biochemical Methods"
Plumer "Practicals"

BS 419
Educational/Industrial Tour

The students of M.Sc. Biochemistry will undergo educational/industrial tour in biochemistry based industry/research institution for practical awareness at the end of 2nd semester. The students have to submit the report of visit based on which satisfactory or unsatisfactory non-creditable grades will be given to the students.