

FI - 01
2018-19

Dr. G. R. DAMODARAN COLLEGE OF SCIENCE (AUTONOMOUS), COIMBATORE -14
B. Sc. BIOTECHNOLOGY, Scheme of examination under CBCS – 2018 - 2019

Sem	Part	Course Category	Course Title	Credits	Marks			Hrs/ Wk	Exam duration	
					CA	TEE	Total			
I	I	Language	Tamil I/Hindi I/ French I/ Malayalam I	3	25	75	100	4		
	II	English	English I	3	25	75	100	5		
	III	Core	Microbiology	4	25	75	100	5		
	III	Core	Biochemistry and Enzymology	4	25	75	100	5		
	III	Core	Bioanalytical Techniques	4	25	75	100	5		
	III	Core	Practical I – Lab in Basic Biological Techniques	-	-	-	-	4		
	IV	Skill Based Subject	General Awareness	2	25	75	100	2		
II	I	Language	Tamil II/Hindi II/ French II/ Malayalam II	3	25	75	100	4		
	II	English	English II	3	25	75	100	5		
	III	Core	Mathematics and Biostatistics	4	25	75	100	6		
	III	Core	Cell Biology and Genetics	4	25	75	100	5		
	III	Core	Practical I - Lab in Basic Biological Techniques	4	40	60	100	5		
	IV	Skill Based Subject	Training in Clinical Microbiology*/ Clinical Biochemistry*/ Hospital Management*	2	NA	100	100	-		
	IV	Envtl. Studies	Environmental Awareness	2	25	75	100	4		
III	I	Language	Tamil III/Hindi III/ French III/ Malayalam III	3	25	75	100	4	Theory : 3 hrs	
	II	English	English III	3	25	75	100	5		
	IV	Basic Tamil I/ Advanced Tamil I/ Non major Elective I	Basic Tamil I/ Advanced Tamil I	2	100	NA	100	-		
	IV		Personality Development and Soft Skills		40	60				
	III	Core	Molecular Biology	4	25	75	100	6		
	III	Core	Immunology	4	25	75	100	6		
	III	Allied	Computer Programming - PERL	5	25	75	100	4		
	III	Core	Practical II - Lab in Basic Biotechnology	-	-	-	-	4		
	IV	Skill Based Subject	Professional Communication	2	25	75	100	2		Practical : 6 hrs
	V	Extension Activities	NSS	1	Grade			-		
IV	Value Education	Indian Society, People and Culture	2	25	75	100	2			
IV	I	Language	Tamil IV/Hindi IV/ French IV/ Malayalam IV	3	25	75	100	4		
	II	English	English IV	3	25	75	100	5		
	IV	Basic Tamil III/ Advanced Tamil II/Non major Elective II	Basic Tamil III/ Advanced Tamil II	2	100	NA	100	-		
	IV		Basics in Business Process Outsourcing		40	60				
	III	Core	Plant Biotechnology	4	25	75	100	5		
	III	Core	Therapeutic Drugs	4	25	75	100	5		
	III	Allied	Bioinformatics	5	25	75	100	4		
	III	Core	Practical II - Lab in Basic Biotechnology	4	40	60	100	5		
	IV	Skill Based Subject	Course in Basic Computer Applications*/ Course in Computer Language*/ Course in Biostatistics*	2	NA	100	100	-		
	IV	Value Education	Indian Society, People and Culture	2	25	75	100	2		
V	III	Core	Microbial Biotechnology	4	25	75	100	6		
	III	Core	Genetic Engineering	4	25	75	100	6		
	III	Elective	Subject chosen from Group I	5	25	75	100	4		
	III	Core	Practical III - Lab in Advanced Biotechnology	-	-	-	-	4		
	III	Core	Lab Project**	-	-	-	-	5		
	III	Skill Based Subject	Food Biotechnology	2	25	75	100	5		
VI	III	Core	Animal Biotechnology	4	25	75	100	6		
	III	Elective	Subject chosen from Group II	5	25	75	100	4		
	III	Core	Practical III - Lab in Advanced Biotechnology	4	40	60	100	10		
	III	Core	Lab Project**	15	25	75	100	10		
	IV	Skill Based Subject	Training in Networking*/ Multimedia*/ Bioanalytical Techniques*	2	NA	100	100	-		
TOTAL				140			3800			

Elective Papers:

GROUP I	GROUP II
Medical Biotechnology / Nanobiotechnology / IPR and Patenting / Molecular interactions.	Industrial Chemistry / Enzyme technology / Biopharmaceuticals / Cancer Biology

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*Training in Clinical Microbiology / Clinical biochemistry/ Hospital management/
Course in Basic Computer applications/ Course in computer language/ Course in
Biostatistics / Training in Networking / Multimedia / Bioanalytical Techniques -
**Internal evaluation only, report to be evaluated by not less than two faculty
members.**

Break up of marks

**Training in Clinical Microbiology / Clinical biochemistry/ Hospital management/
Course in Basic Computer applications/ Course in computer language/ Course in
Biostatistics/Training in Networking / Multimedia / Bioanalytical Techniques**

1. Content of the report	: 25 marks
2. Practical skills gained	: 15 marks
3. Application of scientific skills	: 25 marks
4. Instrumentation / Report preparation	: 10 marks
5. Presentation	: <u>25 marks</u>
Total	<u>100 Marks</u>

****Lab Project**

In the TEE the project report will be evaluated and viva voce test will be conducted
jointly by the internal (research supervisor) and external examiner.

Break up for CA

1. Interaction frequency and attendance	: 5 marks
2. Timely submission of drafts and proofing	: 5 marks
3. Value Addition/ original ideas	: 10 marks
4. Application of concepts and work execution	: <u>5 marks</u>
Total	<u>25 marks</u>

Break up for TEE (25 marks)

1. Clarity of presentation	: 15 marks
2. Content of report	: <u>10 marks</u>
Total	<u>25 marks</u>

Break up for TEE (50 marks)

1. Methodology	: 10 marks
2. Literature review	: 10 marks
3. Dissertation preparation	: 10 marks
4. Results and discussion	: <u>20 marks</u>
Total	<u>50 marks</u>

Teaching hours for all theory subjects is allocated as 55 - 60 hours. Teaching hours are not same
for all subjects.

EI-03
2018-19

Subject code:

Dr. G. R. DAMODARAN COLLEGE OF SCIENCE (Autonomous), COIMBATORE

B.SC. BIOTECHNOLOGY - 2018 onwards

SEMESTER - I

CORE: MICROBIOLOGY

Objective of the subject: This paper aims to empower the students regarding the microbiology field, sterilization methods, ultra structure of the microbes, microbes associated with diseases.

UNIT I:

(10 hours)

Introduction to Microbiology: History - contribution of Leeuwenhoek, John Needham, Lazzaro Spallazani, Edward Jenner, Louis Pasteur, John Tyndall, Robert Koch and Joseph Lister. Microscopy: Bright field, dark field, phase contrast and electron microscopy (TEM and SEM). Staining techniques: Simple, Gram's, endospore and LPCB.

UNIT II:

(10 hours)

Morphology, ultra structure and general characteristics of prokaryotic and eukaryotic cells: General classification of microbes – Whittaker five kingdom classification. Bacteria – *Escherichia coli*, fungi – *Saccharomyces cerevisiae*, *Aspergillus niger*, algae – *Chlamydomonas* sp. and *Nostoc* sp. - protozoa- *Plasmodium* sp. and *Trypanosoma* sp. and virus – T4 bacteriophage and Pox virus.

UNIT III:

(10 hours)

Sterilization and disinfection: Definitions – Sterilization: Physical methods: Filtration, Heat: steam, flaming, incineration, tyndallisation, dry heat – Radiation - ionising and non-ionising radiation. Chemical agents in sterilization: Phenolics, alcohol, halogens, heavy metals, quaternary ammonium compounds and aldehydes.

UNIT IV:

(15 hours)

Culture media and Microbial growth: Types of culture media. Culture techniques: pure culture, enrichment culture, roll tube culture, stab culture, agar slant culture, anaerobic culture, broth culture, shake culture, slide culture. Growth phases, measurement of growth, continuous growth, synchronous growth and diauxic growth. Effects of environmental factors on microbial growth.

UNIT V:

EI-04
(15 hours) 2018-19

Applied Microbiology: Microbial spoilage of fruits and vegetables. **Industrial production:** citric acid, beer and amylase. Water treatment: Drinking water and wastewater. **Systemic study of bacterial pathogens associated with diseases and their laboratory diagnosis and control:** *Vibrio cholera*, *Corynebacterium diptheria*, *Staphylococcus aureus*, *Salmonella typhi*, *Giardia lamblia*, *Plasmodium vivax*, *Candida albicans*, *Aspergillus niger* and HIV.

Culture Depositories: Microbial Type Culture Collection, Gene Bank and ATCC.

REFERENCES :

1. Microbiology – Pelczar M J. (Jr), E C Chan and N R Krieg, Mc Graw Hill Publishing Company Limited, 1956, Edition: 3.
2. Biology of Microorganisms - Michael T. Madigan, John M. Martinko and Jack Parker, Prentice Hall Inc. New Jersey, 1997. Edition: 8.
3. Principles of fermentation Technology - Stanbury P F, Whittaker A and Hall S J, Aditya Books (P) Ltd., New Delhi, 1997, Edition: 3.
4. Textbook of Medical Parasitology - Jayaram Panicker C K, Jaypee Brothers Medical Publishers (P) Ltd., New Delhi, 2002, Edition: 5.
5. Principles of Microbiology - Atlas R M, WCB McGraw Hill Publications, New Delhi, 1997, Edition: 2
6. Diagnostic Microbiology - Bailey and Scotts, Baron and Finegold, C.V Moshby Publication, 1994, Edition: 9.
7. Microbiology : an introduction - Gerard J Tortora; Berdell R Funke; Christine L Case. San Francisco, CA : Pearson Benjamin Cummings, 2010, 10th Edition.
8. Prescott's Microbiology - Joanne M Willey; Linda Sherwood; Christopher J Woolverton; Lansing M Prescott. New York, NY : Mcgraw-Hill Education, 2017, Edition : 10.
9. Medical microbiology. George F Brooks; Ernest Jawetz; Joseph L Melnick; Edward A Adelberg. New York : McGraw Hill Medical, 2010, Edition : 25.
10. Principles of modern microbiology. Mark Wheelis. New Delhi : Jones and Bartlett Publishers, 2010.
11. Microbiology: Principles and Explorations, Jacquelyn G. Black, Laura J. Black - Science, 2014, Edition : 9.

Subject Code: EI-05
2018-19

Dr. G.R. DAMODARAN COLLEGE OF SCIENCE (Autonomous), COIMBATORE

B. Sc. BIOTECHNOLOGY - 2018 onwards

SEMESTER - I

CORE: BIOCHEMISTRY AND ENZYMOLOGY

Objective of the subject: This paper presents the study of various biomolecules, their structure and properties. The major objective of the paper is to provide knowledge on synthesis, metabolism and degradation of biomolecules and elucidate their role in the operation of the organism.

UNIT I:

(11hours)

Carbohydrates: Structure, classification and optical property; Chemical properties of monosaccharide; Structure and properties of disaccharides - sucrose, maltose and lactose. Polysaccharides - structure and chemical properties of starch, cellulose and glycogen.

UNIT II:

(10 hours)

Lipids: Classification and properties, Structure of fatty acids – saturated and unsaturated fatty acids, Reactions of Fatty acids; Compound Lipids: glycolipids and phospholipids, Derived lipids: Sterol and Cholesterol.

UNIT III:

(12 hours)

Metabolism of carbohydrates: Glycolysis, TCA cycle, Electron Transport chain, Oxidative phosphorylation, Gluconeogenesis.

Lipid Metabolism: Biosynthesis and beta-oxidation of fatty acid: palmitic acid.

UNIT IV:

(12 hours)

Amino acid, Proteins and Nucleic acid: Structure and classification of amino acids, chemical reactions of amino acids due to carboxyl group and amino group. Peptides and peptide bond, Classification of Proteins; Levels of organization - primary structure - insulin, secondary structure- keratin and collagen, tertiary structure - myoglobin and quaternary structure – haemoglobin.

Nucleic acids: Structure and Types of DNA and RNA.

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UNIT V:

(10 hours)

Enzymes: Enzymes as catalysts; International classification of enzymes; Basic principles and factors affecting enzyme activity; Enzyme kinetics: Michaelis Menten equation. Mechanism of enzyme regulation - allosteric enzymes; Active site, coenzymes, activators and inhibitors, isoenzymes.

REFERENCES:

1. Biochemistry-Donald Voet, Judith G. Voet, Published by J. Wiley & Sons, 2010, Edition: 4.
2. Harper's Illustrated Biochemistry- Robert K. Murray, Darryl K. Granner, Peter A. Mayes, Victor W. Rodwell, Published by McGraw-Hill Professional, 2009, Edition: 29.
3. Biochemistry- Geoffrey L. Zubay, Published by Wm. C. Brown Publishers, 1993, Edition: 3.
4. Lehninger principles of Biochemistry- Albert L. Lehninger, David Lee Nelson, Michael M. Cox, Published by W.H. Freeman, 2008, Edition: 5.
5. Biochemistry - Jeremy Mark Berg, John L. Tymoczko, Lubert Stryer, Published by W. H. Freeman, 2006, Edition: 6.
6. Enzymes: Biochemistry, Biotechnology and Clinical Chemistry-Trevor Palmer, Published by Horwood Publishing Limited, 2001, Edition: 5.
7. Advances in Enzymology and Related Areas of Molecular Biology, Eric J. Toone, Hardback, 2011.
8. Biochemistry and Molecular Biology, Daphne C. Elliott, William H. Elliott, Alison Snape, 2014, Edition: 5.
9. Biochemistry, Jeremy M. Berg , Gregory J. Gatto, John L. Tymoczko, Hardback, 2015, Edition: 8.
10. Introduction to Enzyme and Coenzyme Chemistry, T. D. H. Bugg, Publisher John Wiley & Sons Inc, 2012.
11. Biocatalysts and Enzyme Technology, Volker Kasche, Uwe Theo Bornscheuer, Klaus Buchholz, 2012, Edition: 2.

ET-07

Subject code: 2018-19

Dr. G. R. DAMODARAN COLLEGE OF SCIENCE (Autonomous), COIMBATORE

B. Sc. BIOTECHNOLOGY – 2018 onwards

SEMESTER -I

CORE: BIOANALYTICAL TECHNIQUES

Objective of the subject: This paper aims to empower the students regarding the microscopic observation and analytical techniques involved in qualitative, quantitative analysis, separation and purification of biomolecules.

UNIT I:

(10 hours)

Buffers and pH: Laboratory Safety Guidelines. Various ways of expressing the concentrations of solutions - Molarity, Molality, Normality and Mole fraction. Methods of calculating pH from Henderson's Hasselbalch equation, **Measurement of pH** - Glass electrode - Standard hydrogen electrode, Reference electrode, pH indicators and Buffer solution.

UNIT II:

(11 hours)

Centrifugation - Principles and applications – preparative centrifuge, analytical centrifuge; different types of rotors, determination of molecular weight by sedimentation velocity, conversion of rpm to g, separation of organelles.

Colorimetry: Colour and absorption spectra, Beer Lambert's Law, Principle and application.

UNIT III:

(12 hours)

Spectrophotometry: Instrumentation, principles and application of UV-Vis, mass spectrometry. **Fluorimetry:** Instrumentation, principle and application.

Chromatography: Principle, materials, methods and applications: Paper chromatography, thin layer chromatography, Gel permeation chromatography, ion exchange chromatography, affinity chromatography, GC and HPLC.

UNIT IV:

(12 hours)

Electrophoresis: Principle, materials, methods and applications: Paper electrophoresis, Agarose gel electrophoresis, Poly acrylamide gel electrophoresis, Immunoelectrophoresis, Isoelectric focusing.

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UNIT V:

(10 hours)

Tracers and other techniques: Radioactive decay, Units of radio activity, detection and measurement of radioactivity, Geiger-Muller counter, Scintillation counter, Auto radiography, application of radio isotopes in Biological and medical sciences.

REFERENCES:

1. Physical Biochemistry - Application to biochemistry and molecular biology - Freifelder D.M. Published by W.H. Freeman, 2006 - Edition: 2.
2. Principles and Techniques in Practical Biochemistry - Wilson and Walker. Published by, Cambridge University Press. 2000, Edition: 5.
3. Modern Experimental Biochemistry - Boyer R. Published by Academic Press. 2001. Edition: 3.
4. Cell and Molecular Biology: Concepts and Experiments by Karp G. Publisher: John Wiley & Sons. Inc, 2010, Edition: 6.
5. Principles and Techniques of Biochemistry and Molecular Biology, Seventh Edition Edited by Keith Wilson and John Walker Seventh Edition , Cambridge University Press 2010.
6. Bioinstrumentation, L. Veerakumari , MJP publishers; 1 Edition, 2011, Edition 1.
7. Bioanalytical Techniques, Abhilasha Shourie, Shilpa S. Chapadgaonkar, Publisher: The Energy and Resources Institute, TERI, 2015.



Subject Code: EI-09

Dr. G.R. DAMODARAN COLLEGE OF SCIENCE (Autonomous), COIMBATORE 2018-19

B. Sc. BIOTECHNOLOGY- 2018 onwards

SEMESTER – I & II

CORE: PRACTICAL I - LAB IN BASIC BIOLOGICAL TECHNIQUES

Objective of the subject: The scope of this work is to make the students to understand the basic techniques of chemistry, biochemistry, cell biology, microbiology and genetics in detail.

Outline of the laboratory Programme: This Practical focus on the basic tools that the Biotechnology students should learn in the First year.

1. Units of volume, weight, density and concentration measurements and their range in biological measurements
2. Preparation of buffers - PBS, acetate, Tris HCl and citrate
3. Verification of Beer Lamberts Law

I CHEMISTRY

1. Determination of percentage of copper in the given solution using colorimetric method
2. Determination of acid value.
3. Determination of iodine value.
4. Determination of saponification value of oil.
5. Analysis of water samples
 - a. Determination of total hardness of water by complexometry.
 - b. Estimation of soluble chloride in water sample
 - c. Determination of sulphide in water sample
 - d. Determination of percentage of copper in water sample by iodometric method

II BIOCHEMISTRY

1. Estimation of carbohydrates- DNS method
2. Estimation of proteins - Lowry's method
3. Estimation of lipids- Vanillin method
4. RNA estimation- Orcinol method
5. DNA estimation - Diphenyl amine method
6. Enzyme assay for amylase

III CELL BIOLOGY

1. Plant cell types
2. Estimation of chlorophyll pigment.
3. Separation of chlorophyll pigments by paper chromatography.
4. Demonstration of animal handling for experimental purposes

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IV GENETICS

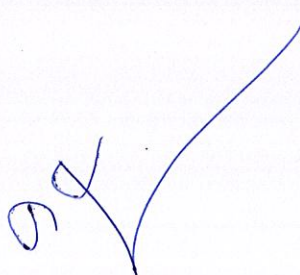
1. Mitosis- all stages in onion root tip
2. Meiosis- stages in *Tradescantia*

V MICROBIOLOGY

1. Microscopy- care and use of microscope
2. Sterilization
3. Sample collection - clinical sample urine and blood
4. Culture media preparation
5. Staining: simple, differential staining
6. Staining of fungi: Lactophenol cotton blue staining
7. Culture Techniques: Inoculation and development of pure culture
8. Biochemical identification of bacteria
9. Maintenance and storage of bacterial strains

REFERENCES:

1. Practical chemistry - Prof. A.O.Thomas - Scientific Book center - Cannanore, Kerala, 1989.
2. Practical genetics- Philip MacDonald Sheppard, Published by Wiley, 1973.
3. Cell Biology: Laboratory Manual- Mary L. Ledbetter, Published by RonJon Publishing, Incorporated, 1993, Edition: 2.
4. Laboratory Manual of Biochemistry by J. Jayaraman Willy Eastern. 1988, Edition: 2.
5. Biochemistry Laboratory Manual For Undergraduates - Tímea Gerczei, Scott PattisonWalter De Gruyter Inc, 2014.
6. Microbiology: A Laboratory Manual, Books A La Carte Edition. Chad T. Welsh; James G. Cappuccino. Publisher: Benjamin Cummings, 2016, 11th Edition.
7. Laboratory Manual of General Biochemistry Frederick A. Bettelheim, Joseph M. Landesberg - 2012.
8. Microbiology Laboratory Manual Biol 2421L Donna Cain, Hershell Hanks, Donna Cain, Hershell Hanks, Mary Weis, Mary Weis, Carroll Bottoms Carro s, and Jonathan Lawson Jonathan Lawson, 2013.
9. Cell Biology Laboratory Manual Pak Safadi-Chamberlain Farida, 2015, Edition: 3.



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2018-19

Subject Code:

Dr. G. R. DAMODARAN COLLEGE OF SCIENCE (Autonomous), COIMBATORE

B. Sc BIOTECHNOLOGY - 2018 onwards

SEMESTER-II

CORE: MATHEMATICS AND BIOSTATISTICS
(EXCLUDING DERIVATIONS)

Objective of the Subject:

To expose students to biostatistical tools used in scientific research and also to develop a basic understanding of matrices, differentiation and integration, statistical measures and testing, which is a very useful modeling tool for computer programming.

UNIT I:

(10 hours)

Matrices: Types of matrices, inverse of a matrix, characteristics equation of a matrix, Eigen value of a matrix. solutions of simultaneous linear algebraic equations in three variables.

UNIT II:

(11 hours)

Differentiation: Standard results, function of function of rule, logarithmic functions, implicit functions, functions with respect to another function, maxima and minima of simple problems.

UNIT III:

(10 hours)

Integration: Standard results, integration by substitution i, integration by substitution ii, integration by substitution iii, integration by parts.

UNIT IV:

(12 hours)

Statistical Measures and Graphs: Introduction, collection of data, classification of data, tabulation of data, uses of statistics. Measures of central tendency: mean, median, mode. Graphical representation of data: histogram, frequency curve, frequency polygon, cumulative frequency curves.

UNIT V:

(12 hours)

Measures of dispersion: Standard deviation, variance, coefficient of variation. correlation: types of correlation, Karl Pearson's coefficient of correlation, spearman's rank correlation. tests of significance: students t-test -test based on t-distribution for single mean and difference of two means, Chi test for goodness of fit.

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2018-19

REFERENCES:

1. Business mathematics and statistics, P R Vittal, Published by Margham, 2012, Edition: 6
2. Statistical Methods, S.P Gupta, Published by Sultan chand and sons, 2012.
3. Introduction to biostatistics and research methods, P S S Sundar Rao and J Richard, Published by PHI Private Limited, 2012 Edition: 5.
4. An Introduction to Biostatistics, N Gurumani, Published by MJP, 2015 Edition: 2



Subject code: *EI-13*
2018-19

Dr. G. R. DAMODARAN COLLEGE OF SCIENCE (AUTONOMOUS), COIMBATORE

B. Sc BIOTECHNOLOGY - 2018 onwards

SEMESTER II

CORE: CELL BIOLOGY AND GENETICS

Objective of the Subject: To develop an understanding of the fundamentals of cell biology. To gain an understanding of the structure and function of living organism and to develop the basic knowledge in genetics and interaction of gene.

UNIT I: (12 hours)

Cell and its organelles: Discovery of cells, development of cell theory; classification of cells. Cell organization - prokaryotes and eukaryotes. Endoplasmic reticulum, Golgi complex, Vacuole, Mitochondria, Chloroplast, Ribosome, Lysosome, Peroxisome, Nucleus, Nuclear envelope with nuclear pore complex, nucleolus, nucleoplasm, and chromatin. Cytoskeleton structures (Microtubules, Microfilaments and Intermediate filaments). Cilia, flagella- structure and function.

UNIT II: (10 hours)

Membrane Structure and Function: Ultra structure of the plasma membrane; Models- Sandwich, Fluid mosaic model. Energy generation in mitochondria and chloroplast.

Cell Division: Introduction to cell cycle, mitosis, meiosis and crossing over.

UNIT III: (12 hours)

Cellular Events: Cell to cell signaling, Nerve cell and transmission of nerve impulses; Muscle cell- types and contraction; Erythropoiesis- genetic and molecular basis of erythrocyte differentiation, morphological specialization of red blood cells.

Fundamentals of Cancer: Apoptosis – Intrinsic and Extrinsic pathway.

UNIT IV (12 hours)

Mendelian Principles and Gene Interaction: Segregation, independent assortment; Non Mendelian inheritance; dominance relations- complete dominance, incomplete dominance, over dominance and co-dominance; multiple alleles diploid organisms. Chromosomal

theory of inheritance; linkage and crossing over- types, mechanism and significance; sex *EI-14*
linkage and sex determination. Chromosomal aberrations- changes in structure and number. *2018-19*


UNIT V:

(10 hours)

Microbial and Population Genetics: Conjugation, transformation and transduction; Population genetics - gene frequency and Hardy Weinberg's Equilibrium; evolutionary genetics, somatic cell genetics and Genetic counseling.

REFERENCES:

1. The Cell- A Molecular Approach – Geoffrey.M. Cooper, Published by Sinauer Associates, Washington. 2015, Edition: 7.
2. Cell and Molecular Biology- Gerald Karp, Janet Iwasa, Wallace Marshall, Published by Wiley international. 2016, Kindle Edition: 8.
3. Molecular Cell Biology- Lodish. Published by W. H. Freeman. 2014, Edition: 7.
4. Cell and Molecular Biology - Philip Sheeler *et al.* Published by Wiley and sons. 1987, Edition: 4.
5. Essential Cell Biology - Bruce Alberts *et al.* Published by Garland publications. 2013, Edition: 4.
6. Cell Biology- David E. Sadava. Published by Panima Publication Corporation. 2004, Edition: 1.
7. Genetics - Peter Russell Published by Pearson education. 2003. Edition: 7.
8. Genetics - Tamarin. Published by Tata Mc Graw Hill. 2006, Edition: 7.
9. Principles of Genetics - Gardner. Published by John Wiley and Sons. 1991, Edition: 8.
10. Genetics - Good enough. Published by Saunders college publications. 1984, Edition: 8.
11. Genetics - Strickberger. Published by Prentice Hall of India Learning. 2008, Edition: 3.
12. Genomes 3 - T A Brown. Published by Garland Science. 2006, Edition: 3.



B. Sc. BIOTECHNOLOGY- 2018 onwards

SEMESTER - III

CORE: MOLECULAR BIOLOGY

Objective of the subject: This paper provides insight on replication, transcription and translation processes in prokaryotes and eukaryotes, various mutations, their repair mechanisms and the basis of cancer genetics. The major objective of the paper is to provide knowledge of molecular biology of prokaryotic and eukaryotic organisms to the students. Helps the student understand the patterns of gene expression and regulation and how a cell works.

UNIT I: (10 hours)

Cell Cycle Regulation: Stages of cell cycle, molecular aspects of mitosis and meiosis
Regulation – Cyclin Dependent protein kinase and cyclins..

Chromosomes: Fine structure, organization and types.

UNIT II: (11 hours)

DNA Replication: Enzymes, proteins and replication mechanism in prokaryotes and eukaryotes; Recombination models and molecular mechanism: Holliday junction model and Double strand break model. DNA repair mechanisms – Excision repair and SOS repair.

UNIT III: (12 hours)

Transcription: promoters, enzymes, mechanism in prokaryotes and eukaryotes; Processing of rRNA, tRNA and mRNA in prokaryotes and eukaryotes and transport of mRNA.

UNIT IV: (11 hours)

Translation: Genetic code, factors and mechanism in prokaryotic and eukaryotic cells; Post translational modifications. Regulation of gene expression - prokaryotic and eukaryotic cells.

Transposons: simple and complex in prokaryotic and eukaryotic systems; Biology of T4 and Lambda phage.

UNIT V:

Mutation: Gene mutation- types, forward, reverse and suppressors; classification based on phenotype; Mutagenesis- spontaneous and induced; Analysis of mutants - specific locus test, filtration enrichment and replica plating.

Cancer: Genetic basis, role of oncogenes, tumour suppressor genes and carcinogens.

REFERENCES:

1. Genes X by Benjamin Lewin. Published by Oxford University Press, U.K., 1997. Edition: 8.
2. Molecular Cell Biology by Darnell, Lodish, Baltimore. Published by Scientific American Books, Inc., 1994, Edition: 5.
3. Genomes 2 by T A Brown. Published by Garland Science Publishing, New York, 2002, Edition:2
4. Genetics: A Conceptual Approach by Benjamin A Pierce. Published by Freeman and Company, New York, 2005. Edition: 2.
5. Molecular Genetics of Bacteria by Larry Snyder and Wendy Champness. Published by ASM Press, Washington DC, 2007. Edition: 3.
6. Molecular Biology by David P Clark. Published by Elsevier Press. 2006, Edition:2.
7. Cell and Molecular Biology by Gerals Karp. Published by John Wiley, 2015, Edition: 8.
8. Molecular Biology of the Cell by Alberts, Bruce et al. Published by Taylor & Francis, 2015, Edition: 6.
9. The Cell - A Molecular Approach by G M Cooper. Published by ASM Press, Washington. 1997.
10. Microbial Genetics by S R Maloy, J E Cronan, and D Friefelder, Published by Jones and Bartlett Learning, Sudbury, Massachusetts. 1994.
11. Molecular Biology of the Gene, Volume I & II by Watson J D, Hopkins N H, Roberts J W, Steitz J A, and A M Weiner. Benjamin Cummings Publications, 1987. Edition: 4.
12. Principles of molecular biology, Burton E. Tropp. Publisher Jones and Bartlett Publishers, Inc, 2013.
13. Molecular biology: principles and practice, Michael M. Cox, Jennifer Doudna. Publisher W.H.Freeman& Co Ltd, 2016, Edition 2.



EI-17
2018-19

Subject code:

Dr. G. R. DAMODARAN COLLEGE OF SCIENCE (Autonomous), COIMBATORE

B. Sc. BIOTECHNOLOGY - 2018 onwards

SEMESTER - III

CORE: IMMUNOLOGY

Objectives of the subject: To gain the basic knowledge in immunology, learn about antigens and antibodies and understand their interactions. To know about the various types of immune cells and organs and how they illicit an immune response, hypersensitivity reactions, basis of vaccine technology.

UNIT I:

(12 hours)

Overview of immune system: Immunity, types of immunity- innate and adaptive immunity. Humoral and cell mediated immunity, Hematopoiesis- differentiation and regulation. Cells of the immune system: Macrophages, B & T- Lymphocytes, Dendritic cells, Natural Killer cells, LAK, Eosinophils, Neutrophils, Mast cells. Organs of the Immune system: Bone Marrow, Thymus, Spleen, Lymph node, MALT, CALT.

UNIT II:

(12 hours)

Antigen and antibody: Antigen Biology- Antigen, Antigenicity, Immunogenicity-Factors, epitopes, haptens, adjuvants, Super antigen. Antibody: Classes, structure & function of antibody (IgG, IgM, IgE, IgA, IgD). Antigen - Antibody interaction: agglutination, precipitation, RIA, Western blotting, ELISA. MHC- types, structure and function (Class I & II). Antigen Processing and Presentation: Pathways and the role of APC's.

UNIT III:

(11 hours)

Effector Mechanism: Cytokines - Properties and function. Complement: Classical and Alternative Pathway. T cell and B cell Receptor. Transplantation Immunology: Immunologic basis of graft rejection, graft versus host reaction.

UNIT IV:

(10 hours)

Hypersensitivity reactions- types, autoimmune diseases - organ specific, systemic autoimmune diseases. Immunodeficiency diseases – SCID, Leukemia and AIDS.

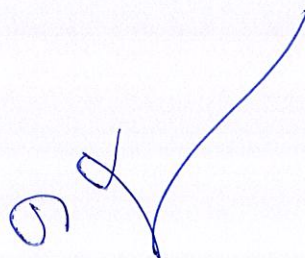


UNIT V:

Vaccine technology: Preparation and production of Monoclonal antibodies, purification, application of MAbs in diagnosis and therapy. Vaccines, Catalytic antibodies, Chimeric antibodies.

REFERENCES:

1. Immunology by Kuby, R A Goldsby, Ythomas J Kindt, Barbara and A Osborne. Published by Freeman company, 2002, Edition: 6.
2. Janeway's Immunobiology – K P Murphy, P Travers, M Walport, Published by Current Biology Publications. 2008. Edition: 6.
3. Fundamental of Immunology by Paul. Published by Lippencott Raven, 2008. Edition: 6.
4. Immunology: An introduction by I R Tizard, published by Saunders College publishers, New York. 1995, Edition: 4.
5. Essential Immunology by I Roitt. Published by Blackwell science, Singapore. 2011. Edition: 12.
6. Cellular and Molecular Immunology Abul K. Abbas, Andrew H. H. Lichtman, Shiv Pillai Elsevier Health Sciences, 2014, Edition 8.
7. Basic Immunology: Functions and Disorders of the Immune System , Abul K. Abbas , Andrew H. H. Lichtman , Shiv Pillai , Elsevier, 2015, Edition 5.
8. Immunology – Joshi KR / Osama NO, Agrobios India, 2012, 5th Edition
9. Undergraduate Immunology: A textbook for tablets and other mobile devices- Clett Erridge, Amazon Digital Services LLC, 2013.
10. Vaccines -Stanley A. Plotkin & Walter Orenstein & Paul A. Offit, BMA Medical Book Awards Highly Commended in Public Health, 2013, Edition 6.



Dr. G. R. DAMODARAN COLLEGE OF SCIENCE (Autonomous), COIMBATORE
B. Sc BIOTECHNOLOGY- 2018 onwards
SEMESTER - III
ALLIED: COMPUTER PROGRAMMING - PERL

Objective of the subject: Recognize and understand fundamentals in computers and to introduce the computer programming, the PERL. To understand the basic concepts of PERL and to develop the logic for the given problem with more flexibility and easiness.

UNIT I:

(11 hours)

Fundamentals of Computing Basics:

Introductory concepts: Operating system, Types of languages – High level, Low level languages, Algorithm & flow chart. **Definitions of terms:** Compiler, Linker, Loader, Interpreter. Applications of Computers

UNIT II: The Internet and Intro to PERL

(12 hours)

Internet terminologies: WWW, FTP, HTML, HTTP. Scripting language. Interpreted Language. **About Perl.** Why Perl?. Basic structure of Perl language – *print* command – First Perl program – Executing your code. **Literals:** Numbers and Strings, Operators, Scalar data, Array data, Hash data. **Variables in Perl:** Scalars, Arrays and Hashes.

UNIT III: Data Structures in Perl

(12 hours)

Scalar Variable: Function list - *chomp*, *chop*, *length*, *chr*, *index*, *uc*, *ucfirst*, *lc*, *lcfirst*. **Array Variable:** Creating an array, Use of range operator in an array, Adding and removing elements, getting the number of elements in an array, Accessing elements in an array. Function list - *reverse*, *sort*, *join*, *split*, *pop*, *push*, *shift*, *unshift*. **Hash Variable:** Printing hash data, accessing and removing elements, Function list - *keys*, *values*, *delete*, *each*, *exists*

UNIT IV: Control Structures and Regular Expressions

(10 hours)

Control Structures: *if*, *else*, *elsif*, *switch*, *while*, *until*, *do...while*, *for* and *for...each*. (Statements associated with loops – *next*, *last*, *redo*, *goto*, *continue*) Regular expressions: Simple string comparisons, Matching, Substitutions, and Translations. Special characters in patterns.

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UNIT V: Simple Programs

(10 hours)

1. Program to store DNA sequence
2. Program to concatenate DNA fragments
3. Program to print the codons
4. Program to remove the last character from protein sequence
5. Program to find the length of the protein sequence
6. Program to remove residues from the end of the protein sequence
7. Program to remove residues from the beginning of the protein sequence

REFERENCES:

1. Genomic PERL: From Bioinformatics Basics to Working Code - Rex A Dwyer, Published by Cambridge University Press, UK, 2003.
2. Bioinformatics, Biocomputing and PERL- Michael Moorhouse and Paul Berry, Published by John Wiley and Sons Ltd., UK, 2004.
3. Beginning Perl for Bioinformatics - James Tisdall, Published by O'Reilly & Associates, USA, 2001.
4. Perl Programming for Bioinformatics - Harshawardhan P Bal, Published by Tata McGraw Hill Publishing Company Limited, 2003.
5. Teach yourself Perl 5 in 21 days - David Till and Kamran Husain, Published by Sams Publishing, USA, 1996.
6. CGI Programming with Perl - Scott Guelich, Shishir Gundavaram and Gunther Birznieks, Published by O'Reilly Media, USA, 2000, Edition: 2
7. Programming the Perl DBI - Tim Bunce and Alligator Descartes, Published by O'Reilly Media, USA, 2000.
8. Learning Perl - Randal L. Schwartz, Tom Phoenix & brain d foy, Published by O'Reilly, 2008, Edition:5.
9. <http://perldoc.perl.org/index-functions.html>
10. <http://www.perl.com/doc/manual/html/pod/perlfunc.html>
11. <https://www.perl.org/books/beginning-perl/>



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Subject Code:

Dr. G.R. DAMODARAN COLLEGE OF SCIENCE (Autonomous), COIMBATORE

B. Sc. BIOTECHNOLOGY- 2018 onwards

SEMESTER – III & IV

CORE: PRACTICAL II - LAB IN BASIC BIOTECHNOLOGY

Objective of the subject: On successful completion the subject, student should have understood basic techniques in Immunology, PTC, Enzyme technology and Bioinformatics.

Outline of the laboratory Programme: Practical gives a broad knowledge and Hands on training in all techniques given.

I IMMUNOLOGY

1. Preparation of serum from blood
2. Preparation of antibodies
3. ABO blood grouping
4. Radial immuno diffusion
5. Ouchterlony double diffusion
6. Immuno electrophoresis
7. Rocket Immunoelectrophoresis
8. Osmotic fragility of RBC's
9. RBC and WBC count
10. Differential leukocyte count by Leishmann's staining

II BIOPROCESS TECHNOLOGY

1. Isolation and preservation of industrially important microorganisms
2. Demonstration of Fermentor: Batch and Continuous
3. Citric acid production
4. Penicillin production
5. Amylase production
6. SCP production
7. Lipase Production
8. Protease Production

III PLANT BIOTECHNOLOGY

1. Composition and preparation of MS medium
2. *in vitro* seed germination
3. Micro propagation: single node culture
4. Callus induction and regeneration
5. Somatic embryogenesis and synthetic seeds
6. Embryo culture
7. Anther culture
8. Cell suspension culture

IV BIOINFORMATICS

1. Retrieving gene sequence, protein sequence and an article
2. Finding similar sequences
3. Sequence alignment - pairwise and multiple sequence alignment
4. Phylogenetic analysis
5. Retrieving protein structure from structure database and molecular visualization

REFERENCES:

1. Laboratory Manual on Biotechnology - Prof. P M Swamy, Published by Rastogi Publications, 2008, Edition: 1.
2. General Microbiology: Laboratory Manual - Robert F. Boyd, Published by Times Mirror/Mosby College Pub., 1984, Edition: 2.
3. Microbial Technology: Fermentation Technology - Henry J. Peppler, D. Perlman, Published by Academic Press, 1979, Edition: 2.
4. Animal Cell Culture: A Practical Approach- R. Ian Freshney, Published by IRL Press, 2006.
5. Culture of animal cells: a Manual of Basic Technique- R. Ian Freshney, Published by A R Liss, 2006, Edition: 6.
6. Animal Cell Culture: A Practical Approach- John R. W. Masters Contributor John R. W. Master, Published by Oxford University Press, 2000, Edition: 3.
7. Plant Tissue Culture Concepts and Laboratory Exercise - Robert Nicholas Trigiano, Dennis John Gray, Published by CRC Press, 2000, Edition: 2.



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8. Introduction to Plant Tissue Culture - M K Razdan, Published by Science Publishers, 2003, Edition: 2.
9. Practical Immunology- Frank C. Hay, Olwyn M. R. Westwood, Paul N. Nelson, Leslie Hudson, Published by Blackwell Publishing, 2008, Edition: 4
10. <https://www.ncbi.nlm.nih.gov>
11. <https://www.ncbi.nlm.nih.gov/gene>
12. <https://www.ncbi.nlm.nih.gov/protein>
13. <https://www.ncbi.nlm.nih.gov/pubmed/>
14. <http://blast.ncbi.nlm.nih.gov>
15. <https://www.ebi.ac.uk/Tools/msa/clustalo/>



Dr. G.R. DAMODARAN COLLEGE OF SCIENCE (Autonomous), COIMBATORE

B. Sc. BIOTECHNOLOGY- 2018 onwards

SEMESTER - IV

CORE: PLANT BIOTECHNOLOGY

Objective of the subject: To provide the student knowledge on the basic classification of Plant Kingdom. To gain knowledge on fundamentals of plant tissue culture techniques and its applications in agriculture.

Unit I: (11 hours)

Classification of Plant Kingdom: Systematics: Two Kingdom and Five Kingdom Systems - Salient features of various Plant Groups (Algae, Fungi, Bryophytes, Pteridophytes and Gymnosperms) - Viruses - Bacteria - Algae : Spirogyra - Fungi : Mucor - Bryophyta : Riccia - Pteridophyta : Nephrolepis - Gymnosperms : Cycas.

Unit II: (10 hours)

Basics of Plant tissue culture: History of Plant Tissue Culture, Concepts of cellular Totipotency. Laboratory organization and Safety measures, Sterilization techniques, Surface sterilization of explants, Media Preparation- Media formulation, Nutrients Composition, Growth regulators – Solid and Liquid medium,.

UNIT III: (12 hours)

Plant Cell Culture: Establishment of Callus culture and Cell Suspension culture - its maintenance and limitations. Isolation and culture of Plant Protoplast, Maintenance, Viability and its applications; Anther and Pollen Culture – Applications and limitations, Ovule/Ovary Culture, Zygotic embryogenesis, Molecular aspects of Somatic Embryogenesis and its applications.

UNIT IV: (11 hours)

Organ Culture and Micro propagation: Principles and applications of Embryo culture and rescue; Endosperm culture, Methods of Micro propagation its applications and Limitations, Shoot tip and Meristem culture, Artificial seed production, Simple Freezing method, Encapsulation, Protocol for cryopreservation and restoration.



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(11 hours)

UNIT V:

Application of Transgenic plants: Herbicide resistance, drought tolerance, salt tolerance, disease resistance, pest resistance, insect resistance (Bt cotton); Symbiotic nitrogen fixation in legumes by Rhizobia (nif); edible vaccines; Antisense RNA technology;
Application of PTC in crop improvement – secondary metabolite production, Commercial micropropagation and phytoremediation.

REFERENCES:

1. Plant Tissue Culture Basics and Applied, Timir Baran Jha and Biswajit Ghosh, Universities Press Pvt.Ltd., Himayatnagar, Hyderabad, Revised Edition, 2007.
2. An Introduction to Plant Tissue Culture by M.K. Razdan. Published by Oxford and IBH Publishing Co., New Delhi. 2003, Edition: 2.
3. Plant Biotechnology: The Genetic Manipulation of Plants, by A Slater, Nigel W Scott, Mark R Fowler, Published by Oxford University Press, Oxford. 2008, Edition: 2.
4. Plant Tissue Culture: Theory and Practice by S S Bhojwani and M.K. Razdan, Elsevier Publications, Netherlands, 2004. Revised Edition.
5. An Introduction to Genetic Engineering in Plants, by Mantel, Mathews and Mickee, Blackwell Scientific Publishers. London. 1990.
6. Plant Biotechnology and Transgenic Plants, Edited by Kirsi-Marja Oksman-Caldentey and Wolfgang H Barz, Published by Marcel Dekker, Inc. New York. 2002.
7. Plant Biotechnology (The Genetic Manipulation of Plants) by Adrian Slater, Nigel W Scott and Mark R Fowler. Published by Oxford University press, UK, 2008.
8. Genetic Engineering: Concepts and Applications by R. Suganthi and C.S. Shobana, Published by Kalaikathir Achchagam, Coimbatore - 37, 2013, Edition: 1.
9. Plant tissue culture: techniques and experiments, Roberta h. Smith, publisher Elsevier science publishing Co inc, 2012.
10. Plant Biotechnology and Genetics: Principles, Techniques, and Applications, by C. Neal Stewart, Publication date , ,Publisher John Wiley & Sons Inc, 2016, Edition 2.
11. Plant Cell and Tissue Culture - A Tool in Biotechnology : Basics and Application, by Karl-Hermann Neumann , Ashwani Kumar , Jafargholi Imani, Publisher Springer-Verlag Berlin and Heidelberg GmbH & Co. KG, 2010.
12. Principles of Plant Genetics and Breeding by George Acquaah, Publisher: John Wiley and Sons Ltd, 2012.

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2018-19

Subject code:

Dr. G. R. DAMODARAN COLLEGE OF SCIENCE (AUTONOMOUS), COIMBATORE

B. Sc BIOTECHNOLOGY - 2018 onwards

SEMESTER IV

CORE: THERAPEUTIC DRUGS

Objective of the subject: Upon completion of the course, students will be able to know the basics, classification, administration and mode of action of various drug sources. They can also understand the basic concepts of Siddha system, Ayurvedic system and Allopathic system of medicine. Illustration on the medical conditions like Diabetes and Hypercholesterolemia in relevance to the three systems of medicines gives a clear perspective of the course.

UNIT I:

(11 hours)

Introduction to Drugs: Definition, History and development. Terminologies – Pharmacology, Pharmacodynamics, Pharmacognosy and Pharmacokinetics. Drug Classification – On the basis of Chemical Structure, Drug action, Pharmacological Effect and Molecular Targets.

UNIT II:

(11 hours)

ADME: Sources of drugs – Natural and Synthetic, Different modes of drug Administration, Fate of drug after administration: Definition and concept of absorption, distribution, metabolism and elimination of drug. Bioavailability and half life of drug.

UNIT III:

(11 hours)

Siddha System of Medicine: Basic Concepts, Pancheekaranam theory and its uniqueness in Siddha, Materia Medica, Special therapies of Siddha Medicine.

Ayurvedic System of Medicine: Principles, Three Dhosa Theory, Factors responsible for increase in three dhosas, Principles of treatment

Allopathic and Integrated system of medicine: Definition, History and Applications

UNIT IV:

(12 hours)

Diabetes Mellitus: Definition, Types, Causes, Control measures, Symptoms and Diagnosis: Complications of Diabetes: Acute – Diabetic Ketoacidosis, Chronic: Micro vascular and Macro vascular diseases.

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Hypercholesterolemia: Definition, Causes – Diet and Genetics, Diagnosis.
Complications: Central Obesity and Atherosclerosis.

UNIT V:

(12 hours)

Therapeutics for Diabetes and Hypercholesterolemia: Glycemic and Cholesterol control by diet, **Mode of action, Interaction and Side effects** – Classification of Anti-diabetic drugs Metformin, sulfonyl urea and Insulin therapy; Cholesterol Lowering Medications: Statins. Impact of Siddha and Ayurvedic medicine on both the conditions, **Medicinal plants as drug for treatment** – *Azadirachta indica* (Vembu), *Emblica officinalis* (Nelli), *Aloe barbadensis* (Sotru katralai), *Catharanthus roseus* (Nithya Kalyani) and *Ocimum sanctum* (Tulsi).

REFERENCES:

1. History of Siddha Medicine, Published by Department of Indian Medicine & Homoeopathy, [Government of Tamil Nadu], 1998.
2. Introduction to the Siddha System of Medicine - V. Narayanaswami, Published by A. Anandakumar, Pandit S.S. Anandam Research Institute of Siddha medicine, 1975.
3. Ayurvedic Herbs: A Clinical Guide to the Healing Plants of Traditional Indian Medicine - Virginia M Tyler, M.S. Premila, Published by Routledge Taylor and Francis Group, New York and London, 2006.
4. Siddha medicine. In History of Medicine in India -Sharma, P.V. Published by The Indian National Science Academy, New Delhi, 1992
5. Textbook of Diabetes - Richard I. G. Holt, Clive Cockram, Allan Flyvbjerg, Barry J. Goldstein, W Published by Wiley - Blackwell publications, 2010, Edition: 4.
6. Familial Hypercholesterolemia: New Insights for the Healthcare Professional- Q.
7. Ashton Medicinal Plants for Diabetes - Aaron Matas, 2013. Published by Lulu press, 2013. Edition : 2.
8. Handbook of Ayurvedic Medicinal Plants: Herbal Reference Library - L. D. Kapoor, Published by CRS Press, 2000.
9. Drug-like Properties: Concepts, Structure Design and Methods: from ADME to Toxicity Optimization - Li Di and Edward H.Kerns, Published by Academic Press, Cambridge, 2014, Edition:2

ET-28
2018-19
Subject code:

Dr. G. R. DAMODARAN COLLEGE OF SCIENCE (Autonomous), COIMBATORE

B. Sc. BIOTECHNOLOGY - 2018 onwards

SEMESTER - IV

ALLIED: BIOINFORMATICS

Objective of the paper: To acquire basic knowledge in the field of biological databases and biological information technology in the context of biotechnology applications.

UNIT I: (12 hours)

Biological Databases: History of Bioinformatics, scope and applications of Bioinformatics, Biological data used in Bioinformatics, Biological databases – features, types and classification with respect to the sequence: Primary nucleic acid sequence databases: NCBI-GenBank, DDBJ and EMBL; Primary protein sequence databases: PIR, Swiss-Prot; Secondary databases: SMART and PFam; Composite databases: OWL. Other popular resources in NCBI: PubMed, OMIM, Entrez.

UNIT II: (12 hours)

Sequence Alignment: Definitions: homology, similarity, identity and gaps. Local and global alignment: Needleman Wunsch and Smith Watermann Algorithm. **Pairwise sequence alignment:** methods, significance, limitation and tools. **Similarity Searching:** BLAST: List, extent, e-value and p-value, principles of BLAST search, types of BLAST.

UNIT III: (11 hours)

Multiple sequence Alignment: Methods, significance and tools: ClustalX and ClustalW. **Conserved Domains:** Databases of conserved domains: PRINTS and BLOCKS. Integrated multiple sequence alignment: InterPro and MetaFam.

UNIT IV: (11 hours)

Phylogenetic Analysis & Molecular Visualization: Phylogenetic Trees: Node, internode, cladogram, phylogram, dendrogram, phenotypic and gene trees; Phylogenetic analysis methods; Applications of phylogeny. Difference between offline, online tool, academic

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licensed software and commercial software. **Molecular Visualization:** RasMol and QMol:
Importance of molecular visualization.

UNIT V:

(11 hours)

Protein Structure - Databases and Prediction Methods: Structural Databases: Protein Data Bank. **Protein Structure Classification Databases:** SCOP and CATH. **Protein Structure Modeling:** Comparative modeling, Abinitio Prediction, Threading. Protein Folding. Molecular Docking.

REFERENCES:

1. Bioinformatics Methods and Applications: Genomics, Proteomics and Drug Discovery by Rastogi S C., Namita Mendiratta, Parag Rastogi. Published by Prentice Hall of India Private Limited, New Delhi, 2013, Edition: 4.
2. Bioinformatics and Functional Genomics by Jonathan Pevsner, Published by John Wiley, 2015, Edition: 3.
3. Bioinformatics Sequence and Genome Analysis by David W. Mount. Published by Cold Spring Harbor Laboratory Press, 2004, Edition: 2.
4. Introduction to Bioinformatics by Attwood, T.K. and D.J. Pary Smith. Published by Addison Wesley Longman Limited, 1999.
5. <https://www.ncbi.nlm.nih.gov/>
6. www.embl.org/
7. www.ddbj.nig.ac.jp/
8. <http://www.openrasmol.org/>



Dr. G.R. DAMODARAN COLLEGE OF SCIENCE (Autonomous), COIMBATORE

B. Sc. BIOTECHNOLOGY- 2018 onwards

SEMESTER - V

CORE: MICROBIAL BIOTECHNOLOGY

Objective of the subject: This paper provides the thorough knowledge about microorganisms and their applications in the production of various products for industrial and commercial uses using microorganisms. Students will get the idea of fermentation technology, media formulation and types of fermentors and how economically important products are produced and help to find out new methods and applications of microorganisms in environment conservation.

UNIT I: (10 hours)

Fermentation and fermentor: Historical perspective; medium formulation and sterilization; Types of fermentation: ethanolic and lactic acid fermentaion, solid state and submerged fermentation; Basic functions of fermentor, Types of fermentor, Design of different parts of fermentor.

UNIT II: (12 hours)

Microbial food products: Alcoholic beverages: Wine, distilled spirit, cider; Dairy products: Cheese, butter, yoghurt; Plant products: Bread, soy sauce, sauerkraut, coffee beans, cocoa, tofu and preserved olives; Food preservatives and supplements: Nisin, Ascorbic acid, vinegar, carotenoids, cobalamin, riboflavin.

UNIT III: (12 hours)

Microbial enzymes and industrial solvents: Commercial microbial enzyme production process; Microbial enzymes and its applications: proteases, lipases, carbohydrases, miscellaneous enzymes; Organic solvents: ethanol, butanol; Fuels: methane, hydrogen; Amino acids: glutamic acid, lysine; Exopolysaccharides: xanthan gum

UNIT IV: (12 hours)

Microbial health care products: Antibiotics: penicillin, streptomycin, tetracycline; Bacterial vaccines: live attenuated, inactivated, recombinant, DNA vaccines; Therapeutic proteins:

DNase, erythropoietin, human growth hormone, insulin, interferons, interleukins, Tissue plasminogen activators, collagen.

UNIT V:

(10 hours)

Microbes and environment: Bioelectricity, biomining, biogas, biofertilizers, biopesticides, biofuels, bioplastics: source, production, advantages and application.

REFERENCES:

1. Principles of Fermentation Technology, P.F. Stanbury and A. Whitaker, Published by Pergamon press, 2016, Edition: 3.
2. Microbial Biotechnology: Fundamentals of Applied Microbiology-Alexander N. Glazer, Hiroshi Nikaïdo, Published by Cambridge University Press, 2007, Edition: 2.
3. Industrial Microbiology: An Introduction, Michael J Waits, Neil N Morgan, John S Rockey and Gary Higton, Published by Black Well Science Ltd, 2001, Edition: 1.
4. Microbial Biotechnology: Principles and Applications -Yuan Kun Lee, Lee Yuan Kun, Published by World Scientific, 2006, Edition: 2.
5. Microbial Biotechnology - Saikai, Ratul, Published by New India Publishing, 2008.
6. Industrial Microbiology -Lester Earl Casida, Published by Wiley, 2006,.
7. Industrial Microbiology - Samuel Cate Prescott, Cecil Gordon Dunn, Published by McGraw-Hill, 2016



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2018-19

Subject code:

Dr. G. R. DAMODARAN COLLEGE OF SCIENCE (Autonomous), COIMBATORE

B. Sc. BIOTECHNOLOGY - 2018 onwards

SEMESTER - V

CORE: GENETIC ENGINEERING

Objective of the subject: This paper provides the student a thorough knowledge in principles and methods in genetic engineering, vectors in gene cloning, transformation in higher organisms. The main objective of the paper is to expose students to application of genetic engineering, various fields of biotechnology, medicine and research areas. This paper will help the student to get a grasp of the latest advances in genetic engineering, which is a powerful tool in modern Biotechnology.

UNIT I:

(10 hours)

DNA modifying enzymes: DNA modifying enzymes and their uses: Nucleases, Restriction enzymes, DNA ligases, DNA Polymerase, Methylase, *Taq* Polymerase, Reverse Transcriptase, Terminal Transferases, Polynucleotide kinases; Alkaline phosphatase. Sticky ends; Blunt ends; Linkers, Adapters and Homopolymer tailing.

UNIT II:

(12 hours)

Cloning vectors and their applications: Biology and construction of plasmid vectors: pBR322, pUC vectors; Bacteriophage vectors: phagemids, cosmids, shuttle vectors; Expression vectors; M13 vectors; viral vectors: SV40 and retroviral vectors; Artificial chromosomes - PAC, BAC, YAC; Construction of Vectors for the desired gene. Ti plasmid for plant transformation.

UNIT III:

(11 hours)

Basic Recombinant DNA Techniques: Construction of a recombinant molecule. Genetic transformation: Physical and Chemical methods in bacteria; transformation of plants by *Agrobacterium* and biolistic method; Animal transformation by microinjection and liposome mediated transfer method. Identifying the clones of interest: Screening by nucleic acid hybridization, Blotting techniques: Southern; Northern; Western and South-western. Selection of transformants - Marker genes and reporter genes.

UNIT IV:

(12 hours)

Advanced Recombinant Techniques: Construction of genomic libraries (Shotgun cloning), Construction of cDNA libraries. PCR: Methods and types; DNA sequencing, Human genome project; Site directed Mutagenesis; RNA interference; DNA microarray; DNA profiling;

Polymorphism analysis by RFLP, RAPD, AFLP, RACE; minisatellites, microsatellites, Single nucleotide polymorphism.

UNIT V:

(10 hours)

Applications: Gene therapy: cystic fibrosis; DNA forensics; Vaccines; Recombinant hormones: Insulin and Growth hormone, Blood factor: Factor VIII and tissue plasminogen activator; interferons and interleukins.

REFERENCES:

1. Principles of Gene Manipulation, by S. B. Primrose, R. M. Twyman and R.W. Old, Published by Wiley-Blackwell Scientific Publications, 2001, Edition: 6.
2. Gene Cloning and DNA Analysis. An Introduction by T. A. Brown, Published by Blackwell Scientific Publications, 2010, Edition: 6.
3. Recombinant DNA by J D Watson, M Gilman, J Witowski and Mark Zoller, Published by Scientific American Books, 1992, Edition: 2.
4. From Genes to Clones: Introduction to gene technology. Winnacker, E.L. Published by VCH, Weinheim, New York, 1987.
5. Molecular cloning: A Laboratory Manual - Sambrook J, Russell D W, Published by Cold Spring Harbor Laboratory Press, Cold Spring Harbor, New York, 2001, Edition: 3.
6. Comprehensive Biotechnology (Vol.1-4) by Moo-Young, Published by Pergamon press, 2004.
7. Genetic Engineering: Concepts and Applications by R. Suganthi and C.S. Shobana, Published by Kalaikathir Achchagam, Coimbatore - 37, 2013, Edition:1.
8. Recombinant DNA by James D. Watson, Michael Gilman, Jan Witkowski, Mark Zoller. Contributor James D. Watson, Mark Zoller. Published by Scientific American Books, 1992, Edition: 2.



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2018-19

Subject code:

Dr G R DAMODARAN COLLEGE OF SCIENCE (Autonomous), COIMBATORE

B. Sc. BIOTECHNOLOGY - 2018 onwards

SEMESTER -V

ELECTIVE: MEDICAL BIOTECHNOLOGY

Objective of the subject: This course has been designed to provide the student insights into these invaluable areas of biotechnology, which play a crucial role in determining its future use and applications in medicine. Students get an idea about the advantages and disadvantages of Biotechnological applications in diagnostic and therapeutics of different challenging diseases and drug development.

UNIT I:

(10 hours)

Introduction of Medical Biotechnology: Worldwide market in medical biotechnology, revolution in diagnosis, approaches of therapy, FDA: Organization chart and regulatory measures for drug discovery: Investigational new drug. **Drug discovery:** Overview, rational drug design, combinatorial chemistry in drug development, computer assisted drug design, role of bioinformatics in genome based therapy, antisense DNA technology for drug designing.

UNIT II:

(12 hours)

Vaccine technology: Subunit vaccines, drawbacks of existing vaccines, criteria for successful vaccine, peptide vaccine, minicells as vaccines, impact of genetic engineering on vaccine production, viral vector vaccines and AIDS vaccine chiral technology: Principle and applications.

UNIT III:

(11 hours)

Stem cells in therapy: Therapeutic proteins, interleukins, interferons: principle, Production and applications, Gene Therapy: Basic approaches to gene therapy, vectors used in gene therapy, applications of gene therapy in cancer, genetic disorders and AIDS. Therapeutic Cloning.

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(12 hours)

UNIT IV:

Nutraceuticals: Fast-based nutraceutical technology of typical food / food products (bread, cheese, idli, agro-products (oilseeds) and Food derived bioactive peptides.

Biosensors in clinical diagnosis: Use of nucleic acid probes and antibodies in clinical diagnosis and tissue typing.

UNIT V:

(10 hours)

Clinical trials: Phase - I, II and III trial Norms : ICMR guidelines for design and conducting clinical trials, licensing procedure in India.

REFERENCES:

1. Medical Biotechnology: Achievements, Prospects and Perceptions - Albert Sasson, Published by United Nations University Press, 2006.
2. Microbial Biotechnology - Principles and Applications - Lee Yaun Kun. Published by World Science publications, 2006.
3. Genetic techniques for Biological Research by Michels *et al.*, Published by Wiley Publications, 2002.
4. Microbial Biotechnology - Fundamentals of Applied Microbiology by Glazer AN, Nikaido H. Published by WH Freeman, New York, 2015.
5. Methods in Biotechnology and Bioengineering - Vyas. Published by CBS publications, 2002.
6. Lipidomics of Stem Cells - Pebay, Alice, Wong, Raymond CB (Eds.) Humana Press, 2017.
7. The Cell Biology of Stem Cells Editors: Meshorer, Eran, Plath, Kathrin (Eds.) Springer US, 2010



Dr. G.R. DAMODARAN COLLEGE OF SCIENCE (Autonomous) COIMBATORE

B. Sc. BIOTECHNOLOGY- 2018 onwards

SEMESTER - V

ELECTIVE: NANOBIO TECHNOLOGY

Objective of the subject: This paper will provide ample introductory knowledge to the students undergoing this course and make them familiarize with the past, present and latest technologies involved in the synthesis and designing of nano particles for specific applications. The paper is framed to provide the principles, technology and applications of nano materials in Biology to the students.

UNIT I:

(11 hours)

Introduction to Nanotechnology: Definition, history of nanomaterials, classification of nanomaterials, Properties of nanomaterials, concept of nanoscale engineering: size and confinement effects.

UNIT II:

(12 hours)

Synthesis and Characterization of Nanoparticles: Strategies for nano architecture, bottom up, top down and functional approaches; Chemical and physical synthesis of nanoparticles, characteristics of nanoparticles, Characterization of nanoscale materials using UV spectroscopy, SEM, TEM, AFM/STM, XRD and FTIR.

UNIT III:

(11 hours)

Interlinking Biology with Nanotechnology: Bionanomaterials: DNA, protein and lipids based nanostructures- synthesis, characterization and applications; Bionanopores, Biological synthesis of nanoparticles and mechanism: bacteria, fungi, yeast and plants; Molecular Self assembly in biology.

UNIT IV:

(11 hours)

Biological Functionalisation of Nanomaterials: DNA/protein-gold nanoparticle conjugates; DNA nanostructures for mechanics and computing; DNA as smart glue, DNA analyzer as biochips; Biologically inspired nanocomposites; Peptide nanostructures and their applications: electronics, antibacterial agents.

UNIT V:

Application of Nanobiotechnology: Antimicrobial activity of nanoparticles- mechanism; Nanoanalytics- Quantum dots - Bioconjugates in cell and tissue imaging; Diagnosis of cancer and other diseases using bionano systems; Drug and gene delivery; Protein targeting-targeting signals, translocation and sorting; Micelles for drug delivery; Proteins and DNA coupled nanoparticles for biosensors; Nanotechnology in agriculture.

REFERENCES:

1. The Chemistry of Nanomaterials - Synthesis, Properties and Applications – C N R Rao, A Muller, A K Cheetham, Published by John Wiley & Sons, 2006.
2. Nano: The Essentials – T Pradeep, Tata Mcgraw Hill, New Delhi, 2007.
3. Nanobiotechnology: Concepts, Applications and perspectives - Niemeyer C M and Mirkin C A, Wiley-VCH Verlag GmbH and Co., KgaA, Weiheim, 2004.
4. Nanobiotechnology & Nanobiosciences - Claudio Nicolini, Pan Stanford Publishing Pte. Ltd, 2009.
5. Bionanotechnology, Lessons from Nature - S. David Goodsell, Wiley-Liss, Inc, 2004.
6. Handbook of Nanotechnology - B Bhushan, Springer, Heidelberg, 2006.
7. Micro / Nano Replication: Processes and Applications - Shinill Kang, Wiley; 2012, Edition: 1.
8. Scanning Microscopy for Nanotechnology: Techniques and Applications - Weillie Zhou , Zhong Lin Wang, Springer; 2010, Edition 1.



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2018-19

Subject Code:

Dr. G.R. DAMODARAN COLLEGE OF SCIENCE (Autonomous) COIMBATORE

B. Sc. BIOTECHNOLOGY- 2018 onwards

SEMESTER- V

ELECTIVE: IPR AND PATENTING

Objective of the subject: Students are exposed to the basic of IPR including application and obtaining a patent - the significance, knowledge about the copyright and designs. Students also learn about the IPR laws of India and Biotechnology and patents and case studies.

UNIT I:

(10 hours)

Basic concepts of Intellectual Property: Introduction to intellectual property rights; Intellectual property laws; Trade related aspects of Intellectual Property Rights; Forms of IPR like patent, design, copyright and bioethics.

UNIT II:

(12 hours)

Patents: Introduction to patent law and conditions for patentability; Procedure for obtaining patents; rights of a patentee; patent infringements; Biotechnology patents and patents on computer programs; patents from an international perspective.

UNIT III:

(10 hours)

Copyright: Registration procedure and copyright authorities; assignment and transfer of copyright, copyright infringement and exceptions to infringement; Software copyright.

UNIT IV:

(11 hours)

Designs: Introduction to the law on industrial designs; registration and piracy; International perspective; registration, commercial exploitation and infringement.

UNIT V:

(12 hours)

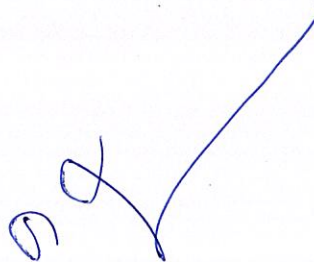
IPR laws: Rights/protection, infringement or violation, remedies against infringement: civil and criminal; Indian Patent Act 1970 and TRIPS; major changes in Indian patent system as post TRIPS effects; contents of patent specification and the procedure for patents; obtaining

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patents; geographical indication; WTO; detailed information on patenting biological products; Plant breeders' and farmers' rights; Biodiversity; Budapest treaty; Appropriate case studies.

REFERENCES:

1. Principles of Cloning - Jose Cibelli, by Robert P. Lanza, Keith H.S. Campbell, Michiel D West, Published by Academic Press, 2002, Edition: 3.
2. Ethics in Engineering - Martin M.W and Schinzinger R. Published by Tata McGraw Hill, New Delhi, 2003, Edition: 2.
4. <http://www.cordis.lu/elsa/arc/about.htm>.
5. Biotechnology, Biosafety and Biodiversity - Scientific and Ethical Issues for Sustainable Development by S Shantharam and Jane F Montgomery, Published by CC New Science Publishers, 1999. Edition: 3



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2018-19
Subject Code:

Dr. G.R. DAMODARAN COLLEGE OF SCIENCE (Autonomous), COIMBATORE

B. Sc. BIOTECHNOLOGY - 2018 onwards

SEMESTER - V

ELECTIVE: MOLECULAR INTERACTIONS

Objective of the subject: To impart basic knowledge of chemistry and interactions in molecules that is the base for drug discovery and new drug target identification

UNIT I:

(11 hours)

Fundamentals of Chemical bonding: Electrovalent bond: stability of electrovalent bond, stability of electrovalent compounds. Covalent bond. Partial ionic character of covalent bonds. Coordination bond, Metallic Bond. Shape of orbitals and hybridization. Molecular geometry.

UNIT II:

(11 hours)

Fundamentals of Atomic and Molecular Orbitals: Theory of atomic and molecular orbitals. Linear combination of atomic orbitals. Quantitative treatment of Valence bond theory. Molecular orbital theory. Resonance structures. Application of bonds and bonds in resonance.

UNIT III:

(11 hours)

Nucleic Acid Structure: Detailed geometries of Watson-Crick, Hoogsteen Base pairs. Non standard base pairs, Sugar Puckering Models, Glycosidic bond, Stacking interactions, Syn-anti conformations, Base pair tautomerism, Classification of A, B and Z type double helices. Secondary structure of RNA. Stereochemistry of nucleic acids.

UNIT IV:

(11 hours)

Protein Structure: Primary, Secondary, Super Secondary, Tertiary (eg: Myoglobin), Quaternary structure of proteins (eg: Haemoglobin), Domains and Motifs, Ramachandran Plot, Principles and mechanisms of protein folding, Non-bonded interactions: Hydrophobic, Electrostatic, Short-range repulsion, Van der Waal's, Hydrogen bonds, Disulphide bridges.



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(11 hours)

UNIT V:

Molecular Interactions: Pi...Pi, C-H...Pi, Protein-Protein, Protein-DNA, DNA-Drug, Protein-Lipid, Protein-Drug, Protein-Carbohydrate, Intercalation, Metalloproteins.

REFERENCES:

1. General Chemistry - Jean B Umland, West Publishing Company, New York, 1993.
2. Quantum Mechanics: Fundamentals and Applications to Technology - Jasprit Singh, Wiley LISS, NJ, 1996.
3. Structural Bioinformatics - Philip E Bourne, Wiley LISS, New Jersey, 2003.
4. Protein Structure and Function - David Whitford, Wiley LISS, UK, 2005.
5. Introduction to Protein Structure - Carl Branden and John Tooze, Garland Publishing Company, New York, 1999. Edition : 2.
6. Biophysical Chemistry, Part-1, the Conformation of Biological Macromolecules - Cantor and Schimmel, W H Freeman & Company, New York, 2002.
7. Introduction to Protein Structure – Creighton, Oxford University Press, UK, 2004.
Edition: 2
8. Principles of Protein Structure - Schulz G E and Schirmer R H, Springer, New York, 2003.
9. Electron Dynamics in Molecular Interactions: Principles and Applications, Frank Hagelberg. Imperial College Press, 2014.
10. The Wonders of Molecular Interactions: The experimentally based Molecular Interaction features, Boris Sedunov. Lambert Academic Publishing, 2016.
11. Molecular Interactions, Peddineni Subrahmanyam Naidu. Scholars' Press, 2015.



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2018-19

Dr. G.R. DAMODARAN COLLEGE OF SCIENCE (Autonomous), COIMBATORE

B. Sc. BIOTECHNOLOGY- 2018 onwards

SEMESTER – V & VI

CORE: PRACTICAL III - LAB IN ADVANCED BIOTECHNOLOGY

Objective of the subject: On successful completion the subject student should have understood the molecular techniques in genetic engineering, Animal cell culture, and Transformation in plants. Other immunotechniques gives good exposure for the students in their application.

Outline of the laboratory programme: Practical gives a broad knowledge and Hands on training in all techniques given.

1. Growth curve of bacteria
2. Phage titration
3. Isolation of genomic DNA from bacteria, plant, animal and purification
4. Agarose gel electrophoresis
5. Isolation of plasmid DNA from bacteria
6. Restriction digestion and ligation of Lambda phage DNA
7. Bacterial transformation, expression and selection
8. Isolation of RNA and separation in denaturing gel
9. Polymerase chain reaction
10. ELISA- Sandwich
11. Western Blotting
12. Immobilization of cells and enzymes
13. Transformation of callus by *Agrobacterium tumefaciens* and selection of transformants
14. Preparation of Animal cell culture media
15. Primary cell culture (Chicken Fibroblast)

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REFERENCES:

1. An Introduction to Practical Biotechnology- S Harisha, Published by Firewall Media, 2005.
2. Novo's Handbook of Practical Biotechnology- C. O. L. Boyce, Boyce, Published by Novo Industri A/S, 1986, Edition :1.
3. Genetic Engineering Principles and Practice, Sandhya Mitra, Published by Macmillan India, 1996, Edition: 1.
4. Molecular Cloning: A Laboratory Manual- Joseph Sambrook, E. F. Fritsch, Tom Maniatis, Chris Nolan Published by Cold Spring Harbor Laboratory, 1989 Edition: 2 (Volume 2), 2001 (Volume 3).
5. Molecular Cloning: A Laboratory Manual- Joseph Sambrook, David William Russell, Published by CSHL Press, 2001 Edition: 3.
6. Animal Cell Culture: A Practical Approach- R. Ian Freshney, Published by IRL Press, 2006, Edition: 5.
7. Practical immunology - Leslie Hudson, F.C. Hay, Published by Blackwell Scientific Public., 2008 Edition: 4.
8. Plant Tissue Culture Concepts and Laboratory Exercise- Robert Nicholas Trigiano, Dennis John Gray, Published by CRC Press, 2000, Edition:2.



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2018-19
Subject code:

Dr. G. R. DAMODARAN COLLEGE OF SCIENCE (Autonomous), COIMBATORE

B. Sc BIOTECHNOLOGY – 2018 onwards

SEMESTER - V

SKILL BASED SUBJECT: FOOD BIOTECHNOLOGY

Objective of the Subject: To impart knowledge and skills related to basic food chemistry and to make the student to understand the causes of food borne illness and predict the micro organism that can spoil a given food, when prepared, processed and stored under given condition and take corrective measures to control the spoilage and pathogenic micro organism in food and also to impart knowledge about the aspects of food and malnutrition

UNIT I: (12 hours)

Food chemistry: Functional properties of sugars and polysaccharides, Proteins and Aminoacids, Lipids, Vitamins and Minerals in food, Maillard browning reaction. Enzymatic browning in foods and industrial applications of enzymes. Water in food, water activity and shelf life of food. Natural food flavours, extraction methods and characterization. Pigments in food and their industrial applications.

UNIT II: (11 hours)

Food Additives: Various additives such as preservatives, antioxidants, emulsifiers, sequesterants, humectants, stabilizers, colours, sweeteners, acidulants with respect to chemistry, food uses and functions in formulations.

UNIT III: (11 hours)

Food Fermentation and Food Borne Diseases: Food Fermentation: Sauerkraut, Oriental Fermented foods, Food borne infections and intoxication- Bacteria, Viruses, Protozoan- toxins
Food spoilage causes and prevention Raw material cleaning, sorting and grading of foods.
Mixing, emulsification

UNIT IV: (11 hours)

Packaging: Functions of packaging, type of packaging materials, methods of packaging and equipment used, barcodes & other marking, packaging regulations, packaging and food

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preservation, disposal of packaging materials, rigid and semi rigid containers, flexible containers; sealing equipment, labeling, aseptic and shrink packaging.

UNIT V:

(11 hours)

Malnutrition: Causes and effect of malnutrition on the vulnerable section of the society, effect of malnutrition on national development. Measures to combat malnutrition – National nutrition policy and programmes. Importance of therapeutic nutrition, Role of ICDS, WHO, UNICEF, NIN, NFI, CFTRI, FTRI, NNMB in combating malnutrition.

REFERENCE:

1. Food science, Potter Norman N, Hotchkiss Joseph, CBS Publications, 2005.
2. Fundamentals of Food Process Engineering, Toledo Romeo, CBS Publications, 2007.
3. Food Processing, Potty V.H, Mulky, M.J, Oxford and IBH, 1993.
4. Technology of Food Preservation, Desrosier and Desrosier, CBS publication, 2006.
5. Frazier, Food Microbiology, Tata McGraw Hill, 2007.
6. Nutrition and Dietetics, Joshi S.A, Tata Mc Graw Hill Publishing Co. Ltd, 2010, Edition: 3.
7. Food processing Technology: Principles and Practice, P.Fellow, Wood Head publishing Limited, Cambridge, England. 2000.



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Subject Code:

Dr G R DAMODARAN COLLEGE OF SCIENCE (Autonomous), COIMBATORE

B. Sc BIOTECHNOLOGY- 2018 onwards

SEMESTER - VI

CORE: ANIMAL BIOTECHNOLOGY

Objective of the paper: To study the basic concepts in basic Zoology, cell growth and differentiation and Animal tissue culture, students gain knowledge on different media used in ATC and cell culture, cell transformation and transgenesis.

UNIT I:

(11 hours)

Basic Zoology: Classification Binomial Nomenclature – Invertebrate and Chordata, **Invertebrate** Athrapods (Cockroach), Poriferons (sponges) mollusks (snail) cnidarians (corals) nematode s(worms) Echinoderms **Chordates-** Pisces (shark) Amphibians (frog) Reptiles (Calotes or Garden lizard) Aves (pigeon) mammalian (rabbit)

UNIT II:

(11 hours)

Developmental Biology: Cell growth and differentiation, Gametes: structure, gametogenesis spermatogenesis, oogenesis, fertilization, cleavage: types of cleavage, blastulation, gastrulation.

UNIT III:

(12 hours)

Animal tissue culture: Laboratory design and maintenance of ATC laboratory. Animal House and Ethics, Tissue culture media – types and preparation, Role of media components in growth and culture of cells. Growth phase, cell-cell interaction and cell adhesion. Types of contaminants: Physical, chemical and biological. Cryopreservation of animal cells.

UNIT IV:

(12 hours)

Types of cell culture: primary and established cultures, three-dimensional cultures. Trypsinization and types, passaging, characterization of cultured cells, counting of cells: live and dead cells. Flow cytometry: introduction, principle and applications. Toxins and cytotoxic assays

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(10 hours)

UNIT V:

Cell transformation: Physical, Chemical, Biological methods of manipulation of cells, study of genetic regulation using animal cells.

Transgenesis: Transgenic animals, production of transgenic mice, cattle, fish. Gene targeting, gene silencing and gene knock-out.

REFERENCES:

1. Animal Cell Culture: A Practical Approach – Ian Freshney. Published by John Wiley & Sons Inc. 2006, Edition: 5.
2. Animal Cell Biotechnology - Portner. Published by Humana Press, 2007, Edition: 2.
3. Principles of Gene Manipulation by Primrose - S B, Twyman R M, Old RW, Published by Blackwell Science Limited, 2001.
4. Animal Cell Culture Methods - Jenny P Mather and David Barnes. Published by Academic Press, 1998.
5. Basic Cell Culture: A practical approach - J M Davis. Published by Oxford University Press, 2002, Edition: 2.
6. Animal Biotechnology and Ethics, Alan J. Holland , Edited by Andrew Johnson. Publisher Springer-Verlag New York Inc. 2013.
7. Textbook of animal biotechnology, Carlos Wyatt, Syrawood Publishing House, 2016.
8. Animal Biotechnology, By (author) VirendraGomase, MadhurMurti, VDM Verlag publisher, 2010.
9. Ruppert and Barnes, R.D. (2006). Invertebrate Zoology, VIII Edition. Holt Saunders International Edition.
10. Young, J. Z. (2004). The Life of Vertebrates. III Edition. Oxford university press.
11. "Barnes, R.D. (1982). Invertebrate Zoology, V Edition"
12. Walter, H.E. and Sayles, L.P; Biology of Vertebrates, Khosla Publishing House.



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2018-19

Subject Code:

Dr G R DAMODARAN COLLEGE OF SCIENCE (Autonomous), COIMBATORE

B. Sc BIOTECHNOLOGY- 2018 onwards

SEMESTER - VI

ELECTIVE: INDUSTRIAL CHEMISTRY

Objective of the subject: To promote critical thinking, problem-solving skills and creative thinking; and to provide the ability to bring the technology into the development of industrial chemistry work.

UNIT I:

(11 hours)

Water: Treatment of water for municipal purposes, sea water as a source of drinking water, Hard and soft water. Types of hardness, softening of water, lime soda process, permutit or zeolite process, ion exchange process, water for industrial purposes, water for laundry work, water for boiler use, water analysis.

UNIT II:

(12 hours)

Fermentation: Introduction, Historical, condition favourable for fermentation, characteristics of enzymes, short account of some fermentation processes: manufacture of beer, fermentation of wort, manufacture of spirits, manufacture of wines, manufacture of vinegar, ethyl alcohol from molasses - preparation of wash - Distillation - alcohol from waste sulphite liquor.

UNIT III:

(12 hours)

Dyes: Introduction, sensation of colour, colour and constitution, classification of dyes according to their mode of application, classification of dyes based on chemical constitution, method of application, general methods of application of dyes on fiber.

UNIT IV:

(12 hours)

Biobleaching: leaching and extraction, mechanism for biobleaching, Direct and Indirect, application and advantages. **Vitamins:** Fat and water soluble vitamins, detection and estimation, source, isolation, diseases caused by its deficiency, adsorption, storage and excretion.

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UNIT V:

(12 hours)

Small scale units: Safety matches, agarbattis, naphthalene balls, wax candles, shoe polish, gum paste, writing/fountain pen ink, chalk crayons, plaster of paris, silicon carbide crucibles. Adhesives: Animal glue, other protein adhesives, starch adhesives, synthetic resin adhesives, rubber based adhesives, cellulose and silicate adhesives.

REFERENCES:

1. Biotechnology - A Textbook of Industrial Microbiology - Wulf Crueger and Anneliese Crueger. Published by Panima Publishing Corporation New Delhi, reprint 2005. Edition: 2.
2. The Vitamins - Jr and Gerald F. Combs. Published by Academic Press, USA 2012. Edition: 4.
3. Water Sources - Awwa Staff, Published by American Water works Association, 2011. Edition: 3.
4. Synthetic Dyes - Gurdeep R. Chatwal. Published by Himalaya Publishing House, Reprint 1993.
5. Industrial chemistry - B.K.Sharma, Goel publishing House – India, 1990-91, Edition: 4.
6. Bioorganic, Bioinorganic and Supramolecular Chemistry - Kalsi P.S. New Age International Private Limited, 2017.
7. Advances in the Dyeing and Finishing of Technical Textiles, Gulrajani, M. L. Elsevier Science, 2013.
8. Handbook of Textile and Industrial Dyeing Clark, M Elsevier Science, 2011-10-25.

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2018-19

Subject Code:

Dr G R DAMODARAN COLLEGE OF SCIENCE (Autonomous), Coimbatore

B. Sc BIOTECHNOLOGY- 2018 onwards

SEMESTER - VI

ELECTIVE: ENZYME TECHNOLOGY

Objective of the subject: This paper presents the basic knowledge on enzyme and enzyme reactions and its characteristics along with the production and purification process to proceed towards various concepts to improve modern biotechnology by the production of bioproducts and methods.

UNIT I:

(10 hours)

Introduction: History and development of enzymology. Enzyme as biocatalysts. Enzyme classification and nomenclature. Mechanisms of enzyme action. Concept of active site. Specificity of enzyme action. General principles of enzyme activity. Units of enzyme activity. Sources of enzymes. Regulatory enzymes. Cofactors. Isoenzymes. Coenzyme.

UNIT II:

(10 hours)

Kinetics of Enzyme Action: Enzyme kinetics, Michaelis-Menten equation, Significance of MM equation, Line weaver-Burk plot, Eadie Hofstee and Hanes Woolf equation. Briggs Haldane modification of MM equation.

UNIT III:

(12 hours)

Inhibitors and types: reversible and irreversible. Enzyme substrate complex. Nucleophilic and electrophilic attack. Role of metal ions in enzyme catalyst. Enzyme specificity. Factors affecting enzyme activity like temperature, pH, etc. Comparison of enzymes with chemical catalysts.

UNIT IV:

(11 hours)

Enzyme production: Membrane bound enzyme extraction. Comparison of enzyme with fermentations. Intrinsic activity of enzymes. Uses of enzymes. Enzyme manufactures. Biochemical applications.

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Physical and chemical techniques for enzyme immobilization. Production and purification of crude enzyme extracts from plant, animal and microbial sources.

UNIT V:

(12 hours)

Applications: In Food Industry. Brewing, Baking and Cheese manufacture, Antioxidants. Uses of enzyme in extraction of natural products. Commercial applications of enzymes. Production of Industrial Enzymes. Modified and Artificial Enzymes. Catalytic Antibodies. Enzymes as food processing aids.

REFERENCES:

1. Handbook of Enzyme Biotechnology-Alan Wisemen, published by Ellis-Horward limited, 1995, Edition: 3.
2. Biological Chemistry-H R Mahler and E Cordes, 1986.
3. Enzymes: Biochemistry, Biotechnology and Clinical Chemistry-Trevor Palmer, Published by Horwood Publishing Limited, 2001, Edition: 5.
4. Enzyme Technology - Pandey A., Webb C., Soccol C. R. and Larroche C. Springer, 2006.
5. Biocatalysts and Enzyme Technology - Buchholz, K., Kasche, V. and Bornscheuer, U. Wiley-VCH, 2012.
6. Enzyme Catalysis in Organic Synthesis: A Comprehensive Handbook- Drauz K., Gröger, H. and May O. Wiley-VCH Verlag & Co, 2012.
7. Methods in Enzymology- Berger SL, Kimmer AR, Academic Press, 1987.
8. Enzymes in Food Technology- Whitehurst and Law, CRC Press, Canada, 2002.
9. Bio & Enzyme Engineering - Manjula, P. and Dawn, S.S. Scitech Publications (India) Pvt Ltd., Chennai, 2004.
10. Principles of enzyme technology, M. Y. Khan , Farha Khan, PHI Learning, 2015.
11. Introduction to enzyme and coenzyme chemistry, T. D. H. Bugg. John Wiley & Sons Inc, 2012.
12. Enzymes and enzyme technology Anil Kumar , SarikaGarg.Viva Books, 2015.

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2018-19

Subject code:

Dr. G R D DAMODARAN COLLEGE OF SCIENCE (Autonomous), COIMBATORE

B. Sc BIOTECHNOLOGY - 2018 onwards

SEMESTER VI

ELECTIVE: BIOPHARMACEUTICALS

Objective of the Subject: To enable the students to know the actual path of metabolism of drugs and drug discovery.

UNIT I:

(11 hours)

Biological systems- Solubility- factors, Bio-availability, Agonist, antagonist, synergism; Routes of drug administration, Passage across biological membrane, absorption and distribution of drugs; Binding of drugs to plasma proteins, Drug – dose relationship (ED₅₀, LD₅₀, therapeutic index)

UNIT II:

(11 hours)

Drug Metabolism: Drug metabolism (Phase I and Phase II reaction), Microsomal drug metabolism: hydroxylation, conjugation, deamination, N-oxidation, Azo & nitro reduction; Non-microsomal oxidation – oxidative deamination, purine oxidation, dehalogenation, hydrolysis; Elimination of drugs from the body with reference to renal system.

UNIT III:

(11 hours)

Drug Receptor and Drug Discovery: Drug Receptor: binding forces in drug – receptor interactions, types of receptors, consequence of drug – receptor interaction, isolation and characterization of receptors. Need for developing new drugs, procedure followed in drug designing, molecular modification of lead compounds, Active site determination of enzymes, Design of enzyme inhibitors.

UNIT IV:

(12 hours)

Pharmaceutical products: Antibiotics: penicillin, streptomycin, tetracycline, Vitamins, Plant Secondary metabolites: Alkaloids, flavanoids, steroids, terpenoids.

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(12 hours)

UNIT V:

Use of DNA technology in pharma products: Therapeutic proteins- insulin, human growth hormone, clotting factors, interferons, interleukins, tissue plasminogen activators (tPA), erythropoietin, production, and applications.

REFERENCES:

1. Pharmacology and Pharmacotherapeutics - Satoskar, R.S., Bhandarkar, S.D., Ainapure, S.S, Popular Prakashan, Mumbai. 2002, Edition: 17.
2. Pharmaceutical Biotechnology – Daan Crommelin, Robert D Sindelar. Published by Tailor and Francis publications, New York, 2002.
3. Biopharmaceutical Biochemistry and Biotechnology – Gary Walsh Published by John Wiley & Sons Ltd, England, 2004.
4. Introduction to Drug Design - SN Pandeya, Published by New Age International Publication. 2007.
5. The Pharmacological Basis of Therapeutics, Goodman & Gilman, Laurence L Brunton, Tata McGraw Hill, 2005.
6. Pharmaceutical Dosage Forms and Drug Delivery Systems, Ansel, H.C. Lippincott Williams & Wilkins, 2000.
7. Biopharmaceutics and Clinical Pharmacokinetics: An Introduction, Notari, Marcell Deckker, 2005.



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2018-19
Subject Code:

Dr G R DAMODARAN COLLEGE OF SCIENCE (Autonomous), COIMBATORE

B. Sc. BIOTECHNOLOGY - 2018 onwards

SEMESTER - VI

ELECTIVE: CANCER BIOLOGY

Objective of the paper: To learn the basics and advanced processes of molecular and genetic basis of cancer. It helps to generate novel mechanistic insight into the processes of tumor development and translate these results for the diagnostic and therapeutic strategies.

UNIT I:

(11 hours)

Introduction to cancer: Definition, Cell cycle regulation: intra and extra cellular control of cell division, programmed cell death (apoptosis), intrinsic and extrinsic pathways of cell death. Necrosis, malignancies, angiogenesis; Clinical significances of invasion, Metastatic cascade, Three step theory of invasion.

UNIT II:

(11 hours)

Causes of cancer: Carcinogens, Chemical carcinogenesis; irradiation carcinogenesis; viral carcinogenesis. oxygen free radicals, aging and cancer; genetic susceptibility and cancer; DNA repair defects and their relationship to cancer, mutagens, and mutations.

UNIT III:

(10 hours)

Epidemiology and etiology of cancer: Awareness and challenges faced by cancer patients.

Types of Cancer: Benign Tumor Vs Malignant Tumors, lung, liver, prostate, breast, colorectal and cervical

UNIT IV:

(11 hours)

Molecular genetics of Cancer: Oncogenes, Identification of Oncogenes, detection of Oncogenes, Growth factor and Growth factor receptors that are Oncogenes: p53, Growth Signal Transduction Mechanisms, G – Protein - Linked receptors, Tumor necrosis factor receptor signaling, Tumor growth factor-a signal transduction, Heat shock protein-mediated events.

UNIT V:

(12 hours)

Tumor Immunology: Mechanism of the Immune Response to Cancer: Antigen Presenting Cells; Antigen Processing; T Lymphocytes and T Cell Activation: Cell- Mediated Cytotoxicity.

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Cancer Therapy: Different forms of therapy, Chemotherapy, Radiation Therapy, Immuno therapy, Detection of Cancers. Applications of new technologies in prevention: gene therapy and Stem cell therapy.

REFERENCES:

1. Cancer Biology-Raymond W. Ruddon. Oxford University Press, 2007, Edition: 4.
2. Molecular Biology of Cancer- F.Macdonald, C.H.J Ford, and A.G Casson. Garland science/ Bios scientific Publishers.
3. The Biology of Cancer- Weinberg. Robert A. New York: Garland Science, 2007.
4. Molecular Biology of Human Cancers- Wolfgang Arthr Schulz. Springer.
5. Molecular Biology of Cancer; Mechanisms, targets and therapeutics-Lauren Pecorino. Oxford University press, Edition: 2.

