

Sem	Part	Course Category	Course Title	Credits	Marks			Hrs/Wk	Exam duration
					CA	TEE	Total		
III	I	Language	Tamil III/Hindi III/ French III/ Malayalam III	3	25	75	100	4	Theory : 3 hrs  Practical : 6 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	-	
			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	
	V	Extension Activities	NSS	1	Grade			-	
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 II/ Advanced Tamil II/Non major Elective II	Basic Tamil II/ Advanced Tamil II	2	100	NA	100	-	
			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	-	
<b>TOTAL</b>				140			3800		

Elective Papers:

GROUP I	GROUP II
Medical Biotechnology / Nanobiotechnology / IPR and Patenting / Cancer Biology	Industrial Chemistry / Enzyme technology / Biopharmaceuticals / Human Anatomy and Physiology

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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>
<b>Total</b>	<b><u>100 Marks</u></b>

**\*\*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>
<b>Total</b>	<b><u>25 marks</u></b>

**Break up for TEE (25 marks)**

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

**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>
<b>Total</b>	<b><u>50 marks</u></b>

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

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

**B. Sc. BIOTECHNOLOGY- 2019 onwards**  
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**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.

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**UNIT V:**

(12 hours)

**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.



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2018-19

Subject Code:

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**B. Sc. BIOTECHNOLOGY- 2019 onwards**

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**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.

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**UNIT V:**

**(10 hours)**

**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.

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Subject Code:

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

B. Sc. BIOTECHNOLOGY- 2019 onwards

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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:

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Simple string comparisons, Matching, Substitutions, and Translations. Special characters in patterns.

**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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**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.
8. Introduction to Plant Tissue Culture - M K Razdan, Published by Science Publishers, 2003, Edition: 2.



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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/>

A handwritten signature in blue ink, consisting of a stylized 'O' followed by a series of loops and a long, sweeping tail that curves upwards and to the right.

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Subject  
Code:

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

**B. Sc. BIOTECHNOLOGY- 2019 onwards**

(For the students admitted during 2018-2019)

**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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**UNIT V:**

(11 hours)

**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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Subject Code:

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#### 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.

**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), *Embllica officinalis* (Nelli), *Aloe barbadensis* (Sotru katalalai), *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

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Subject Code:

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

B. Sc. BIOTECHNOLOGY- 2019 onwards  
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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/](http://www.embl.org/)
7. [www.ddbj.nig.ac.jp/](http://www.ddbj.nig.ac.jp/)
8. <http://www.openrasmol.org/>

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**B. Sc. BIOTECHNOLOGY- 2019 onwards**  
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**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 fermentation, 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

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(12 hours)

**UNIT IV:**

**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 Nikaido, 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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**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.

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**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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**B. Sc. BIOTECHNOLOGY- 2019 onwards**

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**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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**UNIT IV:**

(12 hours)

**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

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**SEMESTER - V**

**ELECTIVE: NANOBIOLOGY**

**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.

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**UNIT V:**

**(12 hours)**

**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 - Weilie Zhou , Zhong Lin Wang, Springer; 2010, Edition 1.



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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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**SEMESTER - V**

**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:** Benign and Malignant Tumor, Different Forms of cancer: lung, liver, prostate, breast, colorectal and cervical - Causes, Symptoms and Diagnosis.  
**Cancer Diagnosis:** Biochemical, Imaging and Biopsy – Principle and Procedures. Awareness and challenges faced by cancer patients.

**UNIT IV:** (11 hours)

**Molecular genetics of Cancer:** Oncogenes, p53, Mechanisms of oncogene activation, Role of growth factors and receptors in carcinogenesis - G – Protein - Linked receptors, RAS signaling in cancer, Familial cancer syndromes and the discovery of tumor suppressors, Heat shock protein-mediated events.

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**UNIT IV:**

(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.

**Cancer Therapy:** Different forms of therapy, Chemotherapy, Radiation Therapy, Immunotherapy, 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.



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**B. Sc. BIOTECHNOLOGY- 2019 onwards**  
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**SEMESTER – V & VI**

**CORE: PRACTICAL III - LAB IN ADVANCED BIOTECHNOLOGY**

**Objective of the subject:** On successful completion of the subject student should have understood the molecular techniques in genetic engineering, Animal cell culture, and basics of biopharmaceutical practicals. Advanced techniques incorporated gives good exposure for the students in their real time application.

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

### **I MOLECULAR BIOLOGY**

1. Growth curve of bacteria
2. Phage titration
3. Isolation of genomic DNA from plant and bacteria
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. Immobilization of cells and enzymes

### **II ANIMAL BIOTECHNOLOGY**

9. Preparation of Animal cell culture media
10. Primary cell culture (Chicken Fibroblast)
11. Isolation of genomic DNA from animal Tissue

### **III BIOPHARMACEUTICALS**

1. Plant Sample – Collection, Solvent and Aqueous Extraction, Processing
2. Qualitative Phytochemical analysis
3. Quantitative Phytochemical Analysis
4. Antimicrobial Assay – Disc Diffusion Method and Well Diffusion Method
5. Antioxidant Assay

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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.



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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

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2018-19  
(11 hours)

**UNIT IV:**

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

**REFERENCES:**

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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**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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2018-19  
(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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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)

**Bioleaching:** leaching and extraction, mechanism for bioleaching, 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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**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.

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. DAMODARAN COLLEGE OF SCIENCE (Autonomous), COIMBATORE

B. Sc. BIOTECHNOLOGY- 2019 onwards

(For the students admitted during 2018-2019)

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-availablility, 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.

**UNIT V:**

**(12 hours)**

**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

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B. Sc. BIOTECHNOLOGY- 2019 onwards  
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SEMESTER - VI

ELECTIVE: HUMAN ANATOMY AND PHYSIOLOGY

**Objective of the paper:** The students need to learn fundamentals of anatomical structures and physiology of body organs. This knowledge is helpful to design any instrument. Students get to know about body composition, organs and systems. Syllabus give the insight into the complete body functioning.

**UNIT I:**

(11 hours)

**Introduction to Human Body:** Overview of Anatomy and Physiology, Structural Organization of Human Body, Homeostasis, Medical Imaging: X-Rays, CT Scan, MRI Scan and Ultra Sonography - Principle, Working and Applications, Anatomical and Medical Terminologies.

**Human Tissue:** Tissue: Definition and Origin, Classification and Functions of Epithelial Tissue, Connective Tissue, Muscle Tissue and Nervous Tissue. **Muscular System** - Structure and function of muscles, Muscle contraction-Voluntary and involuntary actions

**UNIT II:**

(11 hours)

**Bone Tissue and Skeletal System:** Bone classification, Structure of Bone, Bones Cells and Tissues, Bone formation and development - Structure, Classification and Function of Axial Skeleton, Appendicular Skeleton and Joints

**Integumentary System:** Layers of Skin, Accessory structures of skin, Functions of Integumentary system

**UNIT III:**

(12 hours)

**Nervous System:** Basic structure and function of nervous system: CNS, PNS and ANS, Structure of Brain and Vertebral Column, Neuron: Structure, Types and Function, Synapse; Function of Nervous Tissue.

**Endocrine System:** Structure and Function of Pituitary Gland and hypothalamus, Thyroid Gland, the Parathyroid Gland, The Adrenal Gland and The Pineal Gland, Gonadal and Placental Hormone and Endocrine Pancreas.

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**UNIT IV:**

(11 hours)

**Circulatory & Cardiovascular System:** Blood: Hematopoiesis, Classification and Function of Erythrocytes, Leucocytes and Thrombocytes - Structure and Function of Heart and Blood Vessels, Cardiac Muscle and Electrical Conductivity, Principle and working of ECG.

**Respiratory System:** Structure and Function of Respiratory system, Structure of Lungs, Process of Breathing, Gas Exchange and Transport.

**UNIT V:**

(12 hours)

**Digestive System:** Digestive System Organs – The Mouth, Pharynx, Esophagus, the Stomach, the Small and Large Intestine , Accessory Organs in Digestion – Liver, Pancreas and Gall Bladder - Structure and Function.

**Urinary System:** Kidney – Structure and Function, Nephrons - Structure and Function, Process of Micturition, Formation of Urine and Characteristics of Urine,

**Reproductive System:** Male reproductive System – Anatomy and Function of Male Reproductive organ, Spermatogenesis and Structure of Sperm. Female Reproductive System - Anatomy and Function of Female Reproductive organ, Oogenesis, Menstrual Cycle.

**REFERENCES:**

1. Human Physiology - Dr. C. Chatterjee I & II. Medical Allied agency, Kolkatta.
2. Sambasiavaiah, Kamalakara Rao and Augustine Chellappa, 1990. A Textbook of Animal Physiology and Ecology, S. Chand & Co. Ltd., New Delhi-110 055, 480 pp.
3. William S.Hoar, 1976. General and Comparitive Physiology, Prentice Hall of India Pvt. Ltd., New Delhi-110 001, 848 pp.
4. Elaine N. Marieb and Katja Hoehn, September 2003. Human Anatomy and Physiology, Benjamin-Cummings Pub Co. 1301 Sansome Street San Francisco, CA 94111-1122.
5. Wilhelm and Patricia Brady. Human Anatomy and Physiology, McGraw-Hill, New York.