

# **B.Sc., Biotechnology**

**Programme Code : UBT**



## **Programme outcome-PO (Aligned with Graduate Attributes) Bachelor of Science (B.Sc.)**

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### **Scientific Knowledge and Critical Thinking**

Apply the knowledge of Life Science, Physical and Chemical Science, Mathematics, statistics, Computer science and humanities for the attainment of solutions to the problems that come across in our day-to-day life/activities.

### **Problem Solving**

Identify and analyze the problem and formulate solutions for problems using the principles of mathematics, natural sciences with appropriate consideration for the public health, safety and environmental considerations.

### **Communication and Computer Literacy**

Communicate the fundamental and advanced concepts of their discipline in written and oral form. Able to make appropriate and effective use of information and information technology relevant to their discipline.

### **Life-Long Learning**

Recognize the need for and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

### **Ethical, Social and Professional Understanding**

Commitment to principles, codes of conduct and social responsibility in order to behave consistently with personal respect. Acquire the responsibility to contribute for the personal development and for the development of the community. Respect the ethical values, social responsibilities and diversity.

### **Innovative, Leadership and Entrepreneur Skill Development**

Function as an individual, and as a member or leader in diverse teams and in multidisciplinary settings. Become an entrepreneur by acquiring technical, communicative, problem solving, and intellectual skills.



**THIAGARAJAR COLLEGE, MADURAI – 9.**  
**(Re-Accredited with ‘A++’ Grade by NAAC)**  
**Department of Botany and Biotechnology**

**Programme Educational Objectives (PEO)**

The objectives of this programme is to equip/prepare the students

<b>PEO1</b>	Graduates of this program will build up competency in basic Biotechnology required for decisive learning and research.
<b>PEO2</b>	Graduates will develop diversified indispensable professional skills through a wide range of laboratory technical training, communication and presentation skills.
<b>PEO3</b>	Graduates will acquire an ability to identify, formulate, and solve biosafety, environmental and socio-ethical issues to contribute service efforts to community in both the professional and private realm.
<b>PEO4</b>	Graduates will amalgamate related topics from their curriculum such as biochemical techniques, cell biology, microbiology, molecular biology, genetic engineering, plant biotechnology, animal biotechnology, environmental biotechnology, computational biology for higher studies, research and other career.
<b>PEO5</b>	Graduates could develop adequate skill to evaluate the scope of biotechnology, understand the complexities of microbes, plants and animal system and address contentious scientific issues in a lucid way.

**Programme Specific Outcomes (PSOs)- B.Sc., Biotechnology**

On the successful completion of B.Sc., Biotechnology the students will

<b>PSO1</b>	Recognize various groups of microbes using specific identification keys and characteristic features.
<b>PSO2</b>	Exhibit the acquired knowledge and appreciate the core concepts of Biotechnology at cellular, biochemical and molecular level with basis of physiology of living system.
<b>PSO3</b>	Identify somaclones and gametoclones using appropriate molecular markers and bioinformatics tools.
<b>PSO4</b>	Demonstrate the principles of inheritance, transgenesis and commercial exploitation of recombinant DNA technology.
<b>PSO5</b>	Exhibit proficiency in selected laboratory skills and the use of bioinstrumentation and computational biology skills in the biological analysis.



**THIAGARAJAR COLLEGE ,MADURAI-9.**  
**(Re-Accredited With A++ Grade by NAAC)**  
**Department of Biotechnology**  
**B.Sc. Biotechnology Curriculum (w.e.f. 2020-21 batch onwards)**  
**Programme Code-UBT**  
**Semester –I**

Course	Code No.	Subject	Hrs/ Week	Credits	Total Hrs	Max Mark CA	Max Mark SE	Total
Part I	U20P111	Tamil	6	3	90	25	75	100
Part II	U20EN11	English	6	3	90	25	75	100
Core 1	UBT20 C11	General Microbiology	5	5	75	25	75	100
Core Lab 1	UBT20 CL11	General Microbiology lab	2	1	30	40	60	100
Core 2	UBT20 C12	Elements of Biotechnology	3	3	45	25	75	100
Generic Elective	UBT20 GE11	Bioinstrumentation	4	4	60	25	75	100
Generic Elective lab1	UBT20 GL21	Bioinstrumentation Lab	2	-	30			
AECC		Environmental Studies	2	2	30	15	35	50
<b>Total</b>			<b>30</b>	<b>21</b>				<b>650</b>

**Semester -II**

Course	Code No.	Subject	Hrs/ Week	Credits	Total Hrs	Max Mark CA	Max Mark SE	Total
Part 1	U20P121	Tamil	6	3	90	25	75	100
Part II	U20EN21	English	6	3	90	25	75	100
Core 3	UBT20 C21	Cytology and Cytogenetics	5	5	75	25	75	100
Core Lab 2	UBT20 CL21	Cytology and Cytogenetics Practical	2	1	30	40	60	100
Core 4	UBT20 C22	MicrobialGenetis	3	3	45	25	75	100
Generic Electiv2	UBT20 GE21	Biomolecules	4	4	60	25	75	100
Generic Electivel ab2	UBT20 GL21	Bioinstrumentation & Biomolecules lab	2	2	30	40	60	100
AECC		Value Education	2	1	30	15	35	50
<b>Total</b>			<b>30</b>	<b>22</b>				<b>750</b>

### Semester-III

Course	Code No.	Subject	Hrs/Week	Credits	Total Hrs	Max mark CA	Max Mark SE	Total
Part 1	U20P131	Tamil	6	3	90	25	75	100
Part 2	U20EN31	English	6	3	90	25	75	100
Core 5	UBT20C31	Molecular Biology	4	4	60	25	75	100
Core 6	UBT20C32	Computational Biology Basics	4	4	60	25	75	100
Core lab3	UBT20CL3 1	Molecular Biology & Computational Biology Basics lab	2	1	30	40	60	100
Generic Elective3	UBT20GE3 1	Genetics & Biostatistics	4	4	60	40	60	100
Generic Elective lab 3	UBT20GL4 1	Genetics & Biostatistics lab	2	-	30	-	-	-
NME1	UBT20NE3 1	Mushroom Technology	2	2	30	15	35	50
<b>Total</b>			<b>30</b>	<b>21</b>				<b>650</b>

### Semester-IV

Course	Code No.	Subject	Hrs/Week	Credits	Total Hrs	Max Mark CA	Max mark SE	Total
Part 1	U20P141	Tamil	6	3	90	25	75	100
Part 2	U20EN41	English	6	3	90	25	75	100
Core 7	UBT20 C41	Immunology and Immunotechniques	4	4	45	25	75	100
Core 8	UBT20 C42	Clinical Laboratory Technology	4	4	45	25	75	100
Core lab 4	UBT20 CL41	Immunology and Immunotechniques & Clinical laboratory technology lab	2	1	30	40	60	100
Generic Elective4	UBT20 GE41	Physiology and Pathology	4	4	60	25	75	100
Generic Elective lab 3&4	UBT20G L41	Genetics and Biostatistics & Physiology lab	2	2	30	40	60	100
NME2	UBT20 NE41	Vocational Biotechnology	2	2	30	15	35	50
<b>Total</b>			<b>30</b>	<b>23</b>				<b>800</b>



### Semester-V

Course	Code No	Subject	Hrs/Week	Credits	Total Hrs	Max marksCA	Max marksSE	Total
Core 9	UBT20 C51	Genetic Engineering	5	5	75	25	75	100
Core 10	UBT20 C52	Bioprocess Technology	5	5	75	25	75	100
Core 11	UBT20 C53	Marine Biotechnology	5	5	75	25	75	100
Core lab 5	UBT20 CL51	Genetic Engineering lab	4	2	60	40	60	100
Core lab 6	UBT20 CL52	Bioprocess Technology lab	2	1	30	40	60	100
Core lab 7	UBT20 CL53	Marine Biotechnology lab	2	1	30	40	60	100
Core Elective1	UBT20 CE51 A/B/C	(A) Applied Microbiology (B) Metabolic pathways (C) Pharmaceutical Biotechnology	5	5	75	25	75	100
SBE1	UBT20 SE51 A/B/C/D	Biomedical Sciences/ Environmental Chemistry/ Biofertilizers and Biopesticides/ Agricultural Biotechnology	2	2	30	15	35	50
<b>Total</b>			<b>30</b>	<b>26</b>				<b>750</b>
	<b>UBT20IN</b>	<b>Internship</b>		<b>2</b>		<b>15</b>	<b>35</b>	<b>50</b>

### Semester –VI

Course	Code No.	Subject	Hrs/Week	Credits	Total Hrs	Max marks	Max SE marks	Total
Core12	UBT20C61	Plant Conservation Biotechnology	5	5	75	25	75	100
Core13	UBT20C62	Animal Biotechnology	5	5	75	25	75	100
Core14	UBT20C63	Environmental Biotechnology	5	5	75	25	75	100
Core lab 8	UBT20CL6 1	Plant Conservation Biotechnology Practical	2	1	30	40	60	100
Core lab 9	UBT20CL6 2	Animal Biotechnology lab	4	2	60	40	60	100
Core lab10	UBT20CL6 3	Environmental Biotechnology lab	2	1	30	40	60	100
Core Elective 2	UBT20 CE61 D/E/F	(D)Forensic Biotechnology (E) Genomics and Proteomics	5	5	75	25	75	100

		(F)Biosafety&IPR						
SBE2	UBT20 SE61 A/B/C/D	Bioprospecting/ Health & Hygiene/ Entrepreneurs in Biotechnology/ Nano Biotechnology	2	2	30	15	35	50
<b>Total</b>			<b>30</b>	<b>26</b>				<b>750</b>
<b>Part V</b>			<b>-</b>	<b>1</b>				

Total Credits for Semesters 1-6 ---142 (21+23+21+23+26+28)

**A) CONSOLIDATION OF CONTACT HOURS AND CREDITS: UG**

Semester	Contact Hrs/ Week	Credits
I	30 hrs.	21
II	30 hrs.	23
III	30 hrs.	21
IV	30 hrs.	23
V	30 hrs.	26
VI	30 hrs.	28
Total	180 hrs	142

**Thiagarajar College (Autonomous): Madurai – 625 009**  
**Department of Biotechnology**  
 (For those joined B.Sc. Biotechnology on or after June 2020)  
 Programme Code: UBT

Course Code	Course Title	Category	L	T	P	Credit
UBT20C31	Molecular Biology	Core 5	4	-	-	4

L – Lecture      T – Tutorial      P- Practicals

Year	Semester	Internal Marks	External Marks	Total Marks
I	II	25	75	100

### Preamble

Appreciate the life process at the molecular level and the regulatory mechanisms in the flow of genetic information.

### Course Outcomes

On the completion of this course the student will be able to

#	Course Outcome	Expected proficiency (EP)	Expected Attainment (EA)
CO1	Acquire knowledge about structural conformation and properties of DNA	80%	78%
CO2	Summarize the various mechanisms in gene transfer.	75%	72%
CO3	Analyze the replicatory and repair mechanisms in prokaryotes & eukaryotes.	70%	65%
CO4	Explain the mechanisms of transcription in prokaryotes & eukaryotes	75%	70%
CO5	Understand the regulation mechanism of gene expression	75%	72%

### Mapping of COs with POs

#	PO1	PO2	PO3	PO4	PO5	PO6
CO1	M	S	S	M	L	M
CO2	L	S	M	S	M	M
CO3	M	S	L	S	M	L
CO4	S	M	S	L	M	L
CO5	S	M	S	S	L	M

S (+++) – Strong      M (++) - Medium      L (+) – Low

## Mapping of COs with PSOs

#	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	S	S	M	M
CO2	S	S	M	L	M
CO3	M	S	M	S	L
CO4	S	M	S	S	M
CO5	S	M	M	S	L

S (++++) – Strong      M (++) - Medium      L (+) – Low

## Blooms Taxonomy:

	CA		End of Semester
	First	Second	
<i>Knowledge</i>	40%	40%	40%
<i>Understand</i>	40%	40%	40%
<i>Apply</i>	20%	20%	20%

## Title of the paper      MOLECULAR BIOLOGY

### Unit I:

Introduction and scope of Molecular Biology. Molecular basis of life – principle - scope and application. Geometrical configuration of DNA- circular, nicked, super coiled and covalently closed circular DNA – DNA properties – DNA denaturation and renaturation kinetics - melting curves – hypochromicity, hyperchromicity, C-value paradox.

### Unit II:

Molecular mechanisms of Gene transfer: Transformation, Conjugation and Transduction- transposable elements – IS elements – Composite transposons. Mutation: gene mutation – spontaneous and induced mutagenesis – Types of mutagens -Physical and chemical - molecular basis of mutation.

### Unit III:

DNA Replication and Repair: Prokaryotic and Eukaryotic DNA replication – Enzymology of Replication, four models of replication – Conservative, semi conservative, rolling circle model, unidirectional, bidirectional and Okazaki fragments. DNA damage and repair.

### Unit IV:

Mechanism of transcriptions: Transcription cycle in Prokaryotes and Eukaryotes. Role of RNA polymerases in transcription. RNA splicing- role of sRNA in splicing - Spliceosome machinery. Genetic code: degeneracy of codons – Wobble hypothesis.

### Unit V:

Translation: mechanism of initiation, elongation and termination. Regulation of gene expression in Prokaryotes and Eukaryotes: lac, ara & trp operons – Catabolite repression in Eukaryotes– Post transcriptional and post translational modifications - Hormonal regulations.

### Text Books:

- Freifelder, D. 2004. Molecular Biology, 4<sup>th</sup> edition. Narosa Publishing House, New Delhi.
- Freifelder's Essentials of Molecular Biology. 2015. 4<sup>th</sup> edition. Edited by Malacinski, Jones and Barlet.

- Turner, P. C. 2001. Plant Molecular Biology, 2<sup>nd</sup> edition. Bios scientific publishers, Oxford
- DeRobertis, E.D.P. and DeRobertis, E.M.F. 2006. Essentials of Cell and Molecular Biology. Holt Saunders Publication, Philadelphia.
- Lee, P. J. 1999. Plant Biochemistry and Molecular Biology, 2<sup>nd</sup> edition. John Wiley and Sons, New York.

**Reference Books:**

- James Watson, D. 2017. Molecular Biology of Gene, 7<sup>th</sup> edition. Pearson education publication, Singapore.
- Benjamin Lewin. 2008. Gene IX. 9<sup>th</sup> edition. Oxford university press, Oxford.

**Web Source:**

- <https://libguides.gvsu.edu/c.php?g=108381&p=701769>
- <https://towson.libguides.com/mbio>
- <https://bmcmolbiol.biomedcentral.com>

**Course designers:**

1. Dr. S.Yogachitra
2. Mrs. S.Siva durga

**Thiagarajar College, Madurai – 625 009**  
**Department of Biotechnology**  
 (For those joined B.Sc. Biotechnology on or after June 2020)  
 Programme Code UBT

Course Code	Course Title	Category	L	T	P	Credit
UBT20C32	Computational Biology Basics	Core-6	4	-	-	4

L – Lecture                      T – Tutorial                      P- Practicals

Year	Semester	Internal Marks	External Marks	Total Marks
II	III	25	75	100

### Preamble

To provide the students with the basic knowledge on computational biology, applications of bioinformatics tools in biological science research.

### Course Outcomes

On the completion of this course the student will be able to

#	Course Outcome	Expected Proficiency	Expected Attainment
CO1	Evaluate the requirements of computers, softwares and other tools for basic computational biology research.	90%	85%
CO2	Illustrate different types of databases in bioinformatics and their applications.	85%	82%
CO3	Describe the pattern and applications of tools in database analysis and evaluation.	80%	78%
CO4	Assess the strategies of sequence alignment, data warehousing and phylogenetic analysis.	80%	75%
CO5	Appraise the applications of computational biology in drug designing.	75%	73%

### Mapping of COs with POs

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	M	S	S	M	M	S
CO2	M	S	S	M	M	M
CO3	S	M	S	S	M	M
CO4	M	M	S	S	M	M
CO5	M	M	M	S	S	M

S (+++) – Strong                      M (++) - Medium                      L (+) – Low

## Mapping of COs with PSOs

	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	M	M	M	M	M
CO2	M	M	M	S	S
CO3	M	S	S	M	S
CO4	M	M	S	M	M
CO5	M	M	S	S	M

S (+++) – Strong      M (++) - Medium      L (+) – Low

## Blooms Taxonomy:

	CA		End of Semester
	First	Second	
<i>Knowledge</i>	40%	40%	40%
<i>Understand</i>	40%	40%	40%
<i>Apply</i>	20%	20%	20%

## Title of the paper: Computational Biology Basics

### Unit I:

History, generations and components of computers. Operating system – MS word, DOS. Important software - types and applications. Networks – types and applications - Search engines - Google, yahoo. Presentation software and tools – Power point, Google meet, Zoom and other recent tools.

### Unit II:

Bioinformatics - description - Biological and Specialized databases – Nucleic acid sequence databases - Genbank, EMBL, DDBJ. Protein sequence databases - Swissprot, TrEMBL, PIRPSD. Genome sequencing methods – manual – Sanger, Maxam & Gilbert method. Automated sequencing methods- recent innovations -an overview.

### Unit III:

Bioinformatics servers and resources – NCBI – EBI- TIGR – GENOMENET – Bibliographic resources– PUBMED, MEDLINE - ENTREZ – Data Mining – techniques, software and other tools – an overview- recent strategies.

### Unit IV:

Sequence patterns and representations – consensus, regular expression, contigs, motifs and blocks. BLAST and FASTA. Pair wise and Multiple sequence alignments – CLUSTAL and Pileup. Phylogenetic analysis – taxonomy and molecular evolution – Phylogenetic trees –description – types – tree construction and analysis.

### Unit V:

Applications of Computational biology –Pharmacokinetics and pharmacodynamics- Drug designing – Drug discovery cycle- Target identification – lead discovery – Structure-based drug design – Modelling of target – small molecule interactions-recent developments in computational biology.

**Text books:**

- Neethu Jebalia and Jeyalakshmi. 2020. Bioinformatics, System Biology and Big Data Analysis- Emerging Trends.
- A.K. Bansal et al., 2020. Introduction to Computational Health Informatics.
- Essential Bioinformatics. Jin Xiong. Cambridge University Press. 2006.
- Attwood, T.K. and D.J. Parrysmith, 2001, Introduction to Bioinformatics. Pearson Education (Singapore) Pte. Ltd., Indian Branch, Delhi.
- Sundararajan, S. and R. Balaji. 2002. Introduction to Bioinformatics. Himalaya Publishing house, Bangalore.
- Kothekar, V. 2004. Introduction to Bioinformatics. Dhruv Publications, New Delhi.
- Raja Ram, F.V. 2013. Fundamentals of Computers. Printice – Hall of India Pvt. Ltd., New Delhi.

**Reference books:**

- Stephen A. Baylor. 2020. Computational Cell Physiology.
- D. Andreas et al., 2020. Bioinformatics- A Practical Guide to the Analysis of Genes and Proteins.
- Bryan Bergersen, M.D., 2003. Bioinformatics computing. Pearson Education (Singapore) Pte. Ltd., Indian Branch, Delhi.
- Rastogi, S.C., Mamita Menderatta, Parag Rastogi, 2004. Bioinformatics – concepts, skills and applications. CBS Publishers & Distributors, New Delhi.
- Westhead, D. R. and J. H. Parish and R.M. Twyman, 2013. Bioinformatics. Viva Books Private Ltd., New Delhi.
- Sahai, S., 1999. Genomics and Proteomics: Functional and computational aspects. Viva Books Private Ltd., New Delhi.
- Cohen, N.C. 2016. Guide book on molecular modeling in drug design. Elsevier, New Delhi.
- P.K. Singh. 2010. Basics of computer- V.K. (India) Enterprises. New Delhi.

**Web Resources:**

- <https://www.ncbi.nlm.nih.gov/pubmed>
- <http://www.ebi.ac.uk/embl.html>
- <http://www.ebi.ac.uk/~sterk/genome-MOT>
- <http://www.ebi.ac.uk/embl/Submission/webin.html>.

**Course Designed by:** Dr. K. Thangavel



**Thiagarajar College (Autonomous): Madurai – 625 009**  
**Department of Biotechnology**  
 (For those joined B.Sc. Biotechnology on or after June 2020)  
 Programme Code: UBT

Course Code	Course Title	Category	L	T	P	Credit
UBT20CL31	Molecular Biology & Computational Biology Basics Practical	Core lab-3	-	-	2	1

L – Lecture      T – Tutorial      P- Practicals

Year	Semester	Internal Marks	External Marks	Total Marks
II	III	40	60	100

### Preamble

Acquire knowledge on extraction methods of Nucleic acids and making mutant strains of Bacteria.  
 Have hands on training on quantitative estimation of nucleic acids  
 To enlighten the basic knowledge on computational tools, software algorithm in bioinformatics.

### Course Outcomes

On the completion of this course the student will be able to

#	Course Outcome	Expected Proficiency	Expected attainment
CO1	Apply the knowledge of extraction procedures of DNA, RNA	85%	83%
CO2	Acquire knowledge of Transformation experiments	85%	80%
CO3	Describe the pattern and applications of tools in database analysis and evaluation	80%	78%
CO4	Illustrate requirements of computers, software and other tools for basic computational biology research.	80%	78%
CO5	Assess the strategies of sequence alignment, data warehousing and phylogenetic analysis.	75%	73%

### Mapping of COs with POs

#	PO1	PO2	PO3	PO4	PO5	PO6
CO1	S	S	L	S	M	S
CO2	S	S	L	S	M	S
CO3	S	M	S	S	M	S
CO4	M	M	S	S	M	S
CO5	M	M	M	S	S	S

S (+++) – Strong      M (++) - Medium      L (+) – Low

## Mapping of COS with PSOs

#	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	M	L	S	L	M
CO2	M	L	M	L	M
CO3	L	M	M	M	S
CO4	M	L	L	L	M
CO5	M	L	S	L	M

S (+++) – Strong      M (++) - Medium      L (+) – Low

## Blooms Taxonomy:

	CA		End of Semester
	First	Second	
<i>Knowledge</i>	40%	40%	40%
<i>Understand</i>	40%	40%	40%
<i>Apply</i>	20%	20%	20%

## Title of the paper: Molecular Biology & Computational Biology Basics Practical

### A. Molecular Biology

1. Isolation of chromosomal DNA in *E. coli*
2. Isolation of RNA from leaf tissues
3. Isolation of plasmids from *E.coli*
4. Phage isolation
5. Transformation experiments in *E.coli*
6. Separation of Nucleic acids by Agarose gel electrophoresis
7. Replica plating technique
8. Demonstration of Conjugation
9. Blue white screening
10. Gradient plate technique

### B. Computational Biology Basics

1. Creating and formatting MS word files-paragraph-table-excel table- creating worksheet -use of symbols and pictures- preparing power point slides - chart using the database.
2. Sequence searching and analysis.
3. Retrieval of sequence from databases.
4. FASTA and BLAST
5. Phylogenetic analysis

### Text books:

- Sarma.G.K.2017. Molecular Biology, A Practical Manual.MJP Publishers, Chennai.
- Walker and Wim.1983. Techniques in Molecular Biology. Springer, New York.
- Fredrick. M. Ausubel, Berney. Short Protocols in Molecular Biology. Fifth Edition. Wiley Publications, UK.

### Reference books:

- Robert.F.Schleif.2003. Practical Methods in Molecular Biology. First Edition. Springer, New York.
- Davies. J.M. 1995. Genome Analysis – A Practical Approach, Oxford University Press. Oxford.
- Link A.L., 1998 2-D Proteome Analysis Protocols, Human press, Totowa, NJ.

- P.K. Singh. 2010. Basics of computer- V.K. (India) Enterprises. New Delhi.

Web Source:

- <https://libguides.gvsu.edu/c.php?g=108381&p=701769>

**Course Designer(s):**Dr. S.Yogachitra, Mrs. S. Siva durga, Dr. K. Thangavel

**Thiagarajar College (Autonomous): Madurai – 625 009**  
**Department of Biotechnology**  
 (For those joined B.Sc. Biotechnology on or after June 2020)  
 Programme Code: UBT

Course Code	Course Title	Category	L	T	P	Credit
UBT20GE31	Genetics and Biostatistics	Generic Elective 3	4			4

**L – Lecture      T – Tutorial      P- Practicals**

Year	Semester	Int. Marks	Ext.Marks	Total
Second	Third	25	75	100

### Preamble

This course provides the knowledge and understanding of basic genetic principles. The students will be able to do univariate and bivariate statistical analysis.

### Course Outcomes

On the completion of the course the student will be able to

#	Course Outcome	Expected proficiency	Expected attainment
CO1	Exhibit Mendel's principle of inheritance and recognize the deviations from them	60%	58%
CO2	Explain the multiple allele and inheritance of sex linked diseases	60%	59%
CO3	Comprehend the mechanism of genetic linkage and crossing over.	60%	55%
CO4	Represent the data presentation and solve the univariate analysis	65%	63%
CO5	Perform bivariate analysis and basic statistical test using MS-Excel	65%	62%

### Mapping of COs with POs

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	M	S	L	S	L	M
CO2	S	M	L	M	L	L
CO3	M	M	S	M	L	S
CO4	S	L	L	S	M	M
CO5	S	L	L	S	L	S

**S (+++) – Strong      M (++) - Medium      L (+) – Low**

### Mapping of COs with PSOs

	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	S	S	M	M
CO2	S	S	M	L	M
CO3	M	S	M	M	L
CO4	S	M	S	M	M
CO5	S	M	M	S	L

**S (+++) – Strong      M (++) - Medium      L (+) – Low**

## Blooms Taxonomy:

	CA		End of Semester
	First	Second	
<i>Knowledge</i>	40%	40%	40%
<i>Understand</i>	40%	40%	40%
<i>Apply</i>	20%	20%	20%

## Title of the paper: Genetics and Biostatistics

### Unit I:

Mendel's laws: Dominance, segregation, independent assortment; Backcross and test cross; Deviation from Mendelian principles: Codominance, incomplete dominance, epistasis, pleiotropy, penetrance and expressivity, phenocopy.

### Unit II:

Multiple alleles: Characters of multiple alleles; symbolism for multiple alleles, inheritance of ABO, H antigen and Bombay type blood groups, Rh factor; Sex determination: XY and XO type, methods, Genic balance concept; Sex linked inheritance: Colour blindness, haemophilia and hypertrichosis. Sex limited inheritance: baldness and length of index finger.

### Unit III:

Linkage & crossing over: Mechanism of linkage, types - complete & incomplete linkages. Linkage in maize and *Drosophila*; Crossing over - theories and mechanism of crossing over, types - simple, double & multiple crossing over, importance of crossing over, interference and coincidence. Quantitative genetics: Polygenic inheritance, heritability and its measurements

### Unit IV:

Biostatistics: Descriptive and inferential statistics; population and sample in biological studies; variables – qualitative and quantitative; Collection of data, Representation of data – table, histogram, pie diagram, frequency curve and ogives; Measures of central tendency – mean, mode and median; Measures of dispersion – Range and Standard deviation; Standard error. Chi-square test and its significance.

### Unit V:

Correlation - types, methods and significance of the coefficient of correlation; Analysis of variance and its application; Statistical software –MS-Excel and introduction of SPSS.

### Text books:

- Verma, P.S. and Agarwal, V. K. 2014. Genetics. S. Chand PVT. LTD company.
- Robert Brooker. 2015. Concepts of Genetics. McGraw-Hill US Higher Ed USE Legacy.
- Gurumani, N. 2004. An Introduction to Biostatistics. MJP publishers, Chennai.
- Khan., IA, Khanum, A. 2004. Fundamentals of Biostatistics second edition, Ukaaz publications, Hyderabad.

### Reference Books:

- Thomas, A. 2014. Introducing Genetics: From Mendel to Molecules. United States: CRC Press.
- Benjamin A.P. 2020. Genetics: A Conceptual Approach. 7<sup>th</sup> Edition, WH Freeman publisher,
- Daniel, W.W (2006) Biostatistics - A foundation for analysis in health sciences, John Wiley (Asia) & Sons, Singapore.

- Gupta S.P. 1987. Statistical Methods. Sultan Chand & Sons Publishers, New Delhi
- Misra, B.N. and Misra, B. K. 1998. Introductory Practical Biostatistics. Naya Prakash, Calcutta.
- Palanichamy, S. and Manoharan, M. 1994. Statistical methods for Biologists, Palani Paramount Publications, Tamil Nadu.

**Course designer(s):** Dr. C. Balachandran

**Thiagarajar College (Autonomous): Madurai – 625 009**  
**Department of Biotechnology**  
 (For those joined other than B.Sc. Biotechnology on or after June 2020)  
 Programme Code: UBT

Course Code	Course Title	Category	L	T	P	Credit
UBT20NE31	Mushroom Technology	NME1	2	-	-	2

L – Lecture      T – Tutorial      P- Practicals

Year	Semester	Internal Marks	External Marks	Total Marks
II	III	15	35	50

### Preamble

Appreciate the importance of mushrooms, develop entrepreneurial skills.

### Course Outcomes

On the completion of this course the student will be able to

#	Course Outcome	Expected proficiency	Expected attainment
CO1	Acquire basic knowledge on mushrooms	80%	76%
CO2	Learn the morphology and life cycle of mushrooms	75%	73%
CO3	Make use of the knowledge in spawn production.	80%	78%
CO4	Develop suitable skills involved in mushroom cultivation	75%	73%
CO5	Apply the knowledge in the production of mushroom products	80%	78%

### Mapping of COs with POs

#	PO1	PO2	PO3	PO4	PO5	PO6
CO1	M	S	S	M	L	M
CO2	L	S	M	S	M	M
CO3	M	S	L	S	M	L
CO4	S	M	S	L	M	L
CO5	S	M	S	S	L	M

S (+++) – Strong      M (++) - Medium      L (+) – Low

### Mapping of COs with PSOs

#	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	S	S	M	M
CO2	S	S	M	L	M
CO3	M	S	M	S	L
CO4	S	M	S	S	M
CO5	S	M	M	S	L

S (+++) – Strong      M (++) - Medium      L (+) – Low

**B.A. P.O.**

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	S			L	S	S
CO2	S			L	M	M
CO3	S			L	S	S
CO4	S			M	S	S
CO5	S			M	S	S

**B.B.A. P.O.**

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	M	M		L		M
CO2	M	M		L		M
CO3	M	S		M		S
CO4	M	S		M		S
CO5	M	S		M		S

**B.Com. P.O.**

	PO1	PO2	PO3	PO4	PO5
CO1		L	M	S	
CO2		L	M	S	
CO3		M	S	S	
CO4		M	S	S	
CO5		M	S	S	

**Blooms Taxonomy:**

	CA		End of Semester
	First	Second	
<i>Knowledge</i>	40%	40%	40%
<i>Understand</i>	40%	40%	40%
<i>Apply</i>	20%	20%	20%

**Title of the paper: Mushroom Technology****Unit I:**

Introduction to mushrooms – History of mushroom Cultivation- Morphology of mushrooms – Life cycle of mushrooms. Types of mushrooms – cultivable, non – cultivable, edible, poisonous, miscellaneous. Nutritional value of mushrooms – mushrooms as functional food.

**Unit II:**

Mushroom Cultivation – temperature, moisture, ventilation, growing space. Cultivation of *Pleurotus sp* and *Agaricus sp*. Spawn and methods of spawning: grain spawn – storage of spawn – casing – cropping and harvesting of fruiting body– Preservation. Do's and don'ts of mushroom growing. Mushroom products: Nutraceuticals, pharmaceuticals, cosmaceuticals.



**Text Books:**

- Nita Bahl. 2000. Hand Book of Mushroom. 4<sup>th</sup> edition. Oxford & Ibh Publishing Co. Pvt Ltd
- Kapoor, J.N.2014. Mushroom cultivation ICAR. New Delhi.
- Banwart George, J. 2012. Basic Food Microbiology, 2<sup>nd</sup> Edition. CBS publishers and distributors, New Delhi.
- Gogoi R, Rathaiah Y, Borah T.R. 2006. Mushroom Cultivation Technology. Scientific Publishers, India.
- Mushroom Technology 2nd Edition 2020 by RAJAN S, CBS Publishers and Distributors
- Krieger, L. C. 2010. The Mushroom Handbook. Sufi Press. 578 P

**Reference Books:**

- Aneja, K.R. 1996. Experiments in Microbiology, Plant pathology. 4<sup>th</sup> edition. Tissue culture and Mushroom cultivation. Wishwa Prakashan, (New Age International (p) Ltd), New Delhi
- Vinesh Mushroom Cultivation Technology (Skill Enhancement Course) B.Sc. Classes – 1 January 2020 by Dr. Anil K. Thakur (Author), Dr. Susheel K. Bassi (Author), Dr. N.S. Atri (Author)

**Web Sources:**

- <http://mushroomspawn.cas.psu.edu/SixSteps.shtml>
- <http://pubs.cas.psu.edu/PubTitle.asp?varTitle=mushroom>
- <http://pubs.cas.psu.edu/PubTitle.asp?varTitle=mushroom>

**Course designer(s)**

1. Dr. S. Yogachitra
2. Mrs. S. Siva durga

**Thiagarajar College (Autonomous): Madurai – 625 009**  
**Department of Biotechnology**  
 (For those joined B.Sc. Biotechnology on or after June 2020)  
 Programme Code: UBT

Course Code	Course Title	Category	L	T	P	Credit
UBT20C41	Immunology & Immunotechniques	Core – 7	4	-	-	4

L - Lecture

T – Tutorial

P – Practicals

Year	Semester	Internal Marks	External Marks	Total Marks
II	IV	25	75	100

### Preamble

Apply the basic principle and techniques of immunology and learn the significance of immunology for human health.

### Course Outcomes

On the completion of the course the student will be able to

#	Course Outcome	Expected Proficiency	Expected Attainment
CO1	Understand the organizational, functional significance of lymphoid organs	65%	63%
CO2	Make out the properties between antigen and antibody	70%	68%
CO3	Comprehend the disease induced immune response	65%	62%
CO4	Acquire knowledge on various immunological pathways	60%	58%
CO5	Exploit knowledge on immunotechniques	70%	68%

### Mapping of COs with PSOs

#	PO1	PO2	PO3	PO4	PO5	PO6
CO1	L	M	L	L	L	M
CO2	L	M	L	L	L	L
CO3	L	L	S	M	M	S
CO4	S	L	L	L	L	M
CO5	M	L	L	M	S	S

S (+++) – Strong

M (++) - Medium

L (+) – Low

### Mapping of COs with PSOs

#	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	S	L	M	S
CO2	M	S	S	L	M
CO3	S	M	M	S	M
CO4	S	S	M	L	L
CO5	S	M	L	M	M

S (+++) – Strong

M (++) - Medium

L (+) – Low

## Blooms Taxonomy:

	CA		End of Semester
	First	Second	
<i>Knowledge</i>	40%	40%	40%
<i>Understand</i>	40%	40%	40%
<i>Apply</i>	20%	20%	20%

## Title of the paper : Immunology & Immunotechniques

### Unit I:

History and scope of immunology. Types of immunity (Innate and Acquired) - Immunization practices :Types of vaccines - Toxoids, killed and attenuated vaccines. Physiology of immune response – humoral and cell mediated immunity. Lymphoid organs – primary and secondary. Hematopoiesis - cells of immune system – Lymphocytes (T cells, B cells), NK cells, neutrophil and macrophage.

### Unit II:

Antigens – characteristics, types, haptens, adjuvant. Immunoglobulins - structure, functions, classes, isotypes, allotypes and idiotypes. Antibody diversity - Mechanism contributing diversity. Class switching. Mechanism of antigen recognition by T and B cells.

### Unit III:

Cytokines – properties and types. T - cell and B - cell receptors. Hypersensitivity – anaphylaxis, cytotoxic, immune complex deposition and cell mediated. Auto immunity - autoimmune diseases. Immunodeficiency diseases – AIDS & SCID.

### Unit IV:

Complement system, components, nomenclature, and activation of complement-classical and alternate pathway. MHC complex - gene organization. HLA genes class I & class II antigens: structure and function - Antigen processing and presentation. Histocompatibility testing. Transplantation - types, graft versus host reactions.

### Unit V:

Immunodiagnosis based on antigen and antibody interaction - precipitation, agglutination, EIA, RIA, ELISPOT assay, immunofluorescence techniques, flow cytometry and Immunohistochemistry. Hybridoma Technology - Monoclonal antibodies - production and applications.

### Text Books:

- Goldsby, R.A., T.J. Kindt, and B.A. Osborne, Kuby 2002. Immunology. Fourth edition. W.H. Freeman and Company, New York.
- Arora, M.P. 2010. Immunology, Ane Books Pvt. Ltd., New Delhi.
- Eli Benjamini, G. Sunshine and Lespowitz, 2000. Immunology – a short course, Fourth Edition, Wiley – Liss, New York.
- Rao, C.V.2008. Immunology, Second Edition, Narosa Publishing House, New Delhi.

### Reference Books:

- Abbas, A.K., A.H. Lichtman and J.S.Pober, 2000. Cellular and Molecular immunology, Fourth Edition, W.B. Saunders Company, London.
- David, M., B.Jonathan, B.R. Davidand R.Ivan, 2008. Immunology, Seventh Edition, Elsevier Publications.

- Tizard, I.R. 2009. Immunology – An Introduction, Fourth Edition, Cengage Learning India Pvt. Ltd., New Delhi.
- Janeway, Jr. C.A. and P.Travers, 2001. Immunobiology, Fifth Edition, Garland Publishing, London.
- Khan, F.H. 2009. Elements of Immunology, Dorling Kindersley India Pvt. Ltd., India.
- Roitt, I., J. Brostoff and D.Male, 2001. Immunology, Sixth Edition, Mosby, London.

**Websites:**

- <https://nptel.ac.in/courses/102/105/102105083/>
- [https://onlinecourses.swayam2.ac.in/cec20\\_bt05/preview](https://onlinecourses.swayam2.ac.in/cec20_bt05/preview)
- <https://www.mooc-list.com/tags/immunology>

**Course designer:** Dr. S. Padmavathy



## Blooms Taxonomy:

	CA		End of Semester
	First	Second	
<i>Knowledge</i>	40%	40%	40%
<i>Understand</i>	40%	40%	40%
<i>Apply</i>	20%	20%	20%

## Title of the paper: Clinical Laboratory Technology

### Unit I:

Hematology: Blood – Components- Plasma and corpuscles –counting of cells – TC and DC, Platelets, Hematocrit test, ESR, Mean corpuscular Hb, BT & CT. Blood Banking: Rh Typing – Slide test, Blood transfusion – Compatibility testing. Blood culture and sensitivity.

### Unit II:

Biochemical profile: Blood glucose-Fasting -Post prandial-Oral Glucose Tolerance Test (OGTT), Lipid profile-Total serum cholesterol, High Density Lipoprotein (HDL), Low density lipoprotein (LDL),Renal profile-Blood Urea Nitrogen(BUN), Creatinine, Urea ,Uric acid. Liverprofile - Bilirubin-Liver enzyme test-protein test.

### Unit III:

Serology: Widal test, VDRL, Rheumatoid factor, A.S.O. titre,C-Reactive Protein . Thyroid Function Test (TFT)-Total Thyroxine(T4),Triiodo thyronine(T3),Rapid testing -RT-PCR.

### Unit IV:

Urine Analysis: Physical properties of Urine – Colour, Volume, Specific gravity, Odour, Turbidity and pH. Chemical examination – urine sugar, albumin, bile salts, Bile pigments, urobilinogen Microscopic Examination of Urine deposits – Cast Crystals – Cells. Principles in Pregnancy Test. Microbial culture and sensitivity.

### Unit V:

Analysis of excretory product and body fluids: Stool examination: Color-microscopic examination, worms. Cerebrospinal Fluid-appearance-cytology –chemistry, Sputum – Microbial analysis, Culture and sensitivity. Semen analysis-physical properties-Microscopic examination.

### Text Book:

- Sood, R, 1999, Medical Laboratory Technology – methods and interpretations – Fifth edition, Jaypee, New Delhi.
- Mukherjee, L.K. 1988, Medical Laboratory Technology – Vol.3 – 2<sup>nd</sup> ed. – Hill Publishing Ltd., New Delhi.
- Connie R. Mahon. Diane G. Tice. 2006. Clinical Laboratory Immunology. 8<sup>th</sup> edition. Pearson Prentice Hall. 325 pp.
- France Talaska Fishbach., Margaret A. Fishbach. 2018. A Manual of laboratory and Diagnostic Tests- 10<sup>th</sup> Edition.
- Dany Spencer Adams , 2014 , Lab Math- 2<sup>nd</sup> Edition.

**Reference Books:**

- Rapael, S.S, 1983, Lynch Medical Laboratory Technology, Fourth edition, W.B. Saunders Co, Singapore.
- Woohan, I.D.P., Heather Freeman, 1990, Micro Analysis in Medical biochemistry, sixth edition, Churchil Livingstone Publishing Ltd., USA.
- John Ridley 2010. Essentials of clinical laboratory science. CLIA. Compliance guide.
  
- Ochei, J and Kolhattar, A. 2000. Medical Laboratory Science – Theory and Practice. Tata Mc Graw - Hill Publishing Company Ltd., New Delhi. India.
- Mary Lou Turgeon , 2018, Clinical Hematology- Theory and Procedures, 6<sup>th</sup> Edition.

**Web Sources:**

- <https://www.pcc.edu/rograms/medical-lab/resources/>
- <https://ashpublications.org/hematology>
- <https://www.bloodline.net/>

**Course designer(s):**

1. Mrs. S. Siva Durga
2. Dr. S. Yogachitra

**Thiagarajar College (Autonomous): Madurai – 625 009**  
**Department of Biotechnology**  
 (For those joined B.Sc. Biotechnology on or after June 2020)  
 Programme Code: UBT

Course Code	Course Title	Category	L	T	P	Credit
UBT20CL41	Immunology and immunotechniques & Clinical Laboratory Technology	Core Lab - 4	-	-	2	1

L - Lecture

T – Tutorial

P – Practicals

Year	Semester	Internal Marks	External Marks	Total Marks
II	IV	40	60	100

### Preamble

Acquire knowledge on haematological parameters, analysis of various parameters of Immunology involved in the normal health of human. Have hands on training on various Immunotechniques, biochemical parameters of urine, various body fluids.

### Course Outcomes

On the completion of the course the student will be able to

#	Course Outcome	Expected Proficiency	Expected Attainment
CO1	Acquire knowledge on hematological parameters cellular components of blood	70%	69%
CO2	Apply knowledge on serological parameters	75%	73%
CO3	Analyze biochemical parameters	70%	68%
CO4	Perform diagnosis tests for infectious agents	65%	62%
CO5	Analyze body fluids and excretory products	70%	65%

### Mapping of COS with POs

#	PO1	PO2	PO3	PO4	PO5	PO6
CO1	M	L	S	L	M	S
CO2	M	L	M	L	M	S
CO3	L	M	M	M	S	S
CO4	M	L	L	L	M	S
CO5	M	L	S	L	M	S

S (+++) – Strong

M (++)- Medium

L (+) - Low

### Mapping of COS with PSOs

#	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	M	L	S	L	M
CO2	M	L	M	L	M
CO3	L	M	M	M	S
CO4	M	L	L	L	M
CO5	M	L	S	L	M

S (+++) – Strong

M (++) - Medium

L (+) - Low



## Blooms Taxonomy:

	CA		End of Semester
	First	Second	
<i>Knowledge</i>	40%	40%	40%
<i>Understand</i>	40%	40%	40%
<i>Apply</i>	20%	20%	20%

Title of the paper: Immunology and immunotechniques & Clinical Laboratory Technology lab

### Immunology and Immunotechniques

1. Total WBC
2. Total RBC count
3. Observation of different white blood cells.
4. Differential cell count
5. Preparation of specific complement protein
6. Preparation of serum
7. Preparation of plasma
8. Isolation of lymphocytes from human blood by density gradient method
9. Electrophoretic separation of serum protein
10. Haemagglutination titration assay
11. Blood grouping and Rh typing
12. Single immunodiffusion technique
13. Double immunodiffusion technique
14. Antibacterial activity of serum
15. Hemolysis
16. Counter current electrophoresis.

### Clinical Laboratory Technology

1. WIDAL test
2. Measurement of Bleeding time and Clotting time
3. Culture analysis of Urine and blood
4. Physical and chemical analysis of urine
5. Microscopic examination of urine for crystals
6. Erythrocyte Sedimentation Rate(ESR)
7. Pregnancy test
8. VDRL
9. Estimation of cholesterol
10. Demonstration of ELISA
11. Analysis of excretory products- Worms in stool.

### Text books:

- Gupta. Talwar.2006. A Handbook of Practical and Clinical Immunology.CBS publishers, India.
- Hannah D.Zane.2001. Immunology, Theoretical and Practical Concepts in Laboratory Medicine. Saunders Publishers, UK.
- Krishna Das.KV.2013. Clinical Medicine, A Text Book of Clinical Methods and Laboratory Investigations. Jaypee publishers, Chennai.

- Harold Varley .2005. Practical Clinical Biochemistry. Fourth Edition.CBS publishers, India.
- Baker.F.J, Selverton.R.E .Introduction To Medical Laboratory Technology. Seventh Edition. Elsevier, USA.

**Reference books:**

- Frank C. Hay, Westwood. 2002. Practical Immunology. Wiley- Blackwell, UK.
- Sainani G. S., Rajesh G Sainani. 2018. A Manual of Clinical and Practical Medicine. Second Edition. Jaypee Publishers, Chennai.
- Gupta. Talwar.2006. AHandbook of Practical and Clinical Immunology.CBS publishers, India.
- Hannah D.Zane.2001. Immunology, Theoretical and Practical Concepts in Laboratory Medicine .Saunders Publishers, UK.
- Krishna Das.KV.2013. Clinical Medicine, A Text Book of Clinical Methods and Laboratory Investigations. Jaypee publishers, Chennai.

**Course designer(s):** **Dr. S. Yogachitra**  
**Mrs. S. Siva durga**  
**Dr. S. Padmavathy**

**Thiagarajar College: Madurai – 625 009**  
**Department of Biotechnology**  
 (For those joined B.Sc. Biotechnology on or after June 2020)  
**Programme Code -UBT**

Course Code	Course Title	Category	L	T	P	Credit
UBT20GE41	Physiology and Pathology	Generic Elective 4	4	-	-	4

L - Lecture

T – Tutorial

P – Practicals

Year	Semester	Internal Marks	External Marks	Total Marks
II	IV	25	75	100

### Preamble

To inculcate the students with the basic information about the physiology of plants and animals and their roles in functioning of an organism and aims at preparing the students in basic understanding of diseases and their pathogenesis.

### Course Outcomes

On the completion of this course the student will be able to

#	Course Outcome	Expected Proficiency	Expected Attainment
CO1	Elucidate different physiological and biochemical mechanisms in plants and animals and their adaptations.	85%	83%
CO2	Assess the role of different biopathways involved in plants.	85%	80%
CO3	Analyze the importance of each component of a system in performing the physiological functions.	80%	78%
CO4	Understand the causes and mechanism of pathogenesis	80%	75%
CO5	Depict a comparative study of the pathophysiology of various system	75%	74%

### Mapping of COs with POs

	PO1	PO2	PO3	PO4	PO5	PO5	PO6
CO1	L	L	S	L	L	M	S
CO2	L	L	S	L	L	M	M
CO3	L	M	L	S	M	S	L
CO4	M	M	L	M	M	M	M
CO5	M	L	L	M	L	M	M

S (+++) – Strong

M (++)- Medium

L (+) - Low

### Mapping of COs with PSOs

	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	M	M	S	M	M
CO2	S	M	M	S	M
CO3	S	S	S	M	S
CO4	M	M	S	M	S
CO5	M	M	S	S	M

S (+++) – Strong

M (++)- Medium

L (+) - Low

## Blooms Taxonomy:

	CA		End of Semester
	First	Second	
<i>Knowledge</i>	40%	40%	40%
<i>Understand</i>	40%	40%	40%
<i>Apply</i>	20%	20%	20%

## Title of the paper: Physiology and Pathology

### Unit I:

Diffusion, osmosis, Water potential and its components – Absorption of water: apoplast, symplast and transmembrane concept – active and passive mechanism – Transpiration- Photosynthesis - Cyclic and non-cyclic photophosphorylation. Carbon fixation: C3, C4 and CAM pathways – Overview of cellular respiration.

### Unit II:

Structure and functions of digestive glands- gastrointestinal hormones, Digestion and absorption of proteins, carbohydrates and lipids. Respiration-external respiration; respiratory movements, breathing; ventilation; process of gaseous exchange; respiratory pigments. Physiology of reproductive system-an overview.

### Unit III:

General functions of blood, blood cells; blood group; blood vascular system; heart beat and functioning of heart; cardiac cycle; blood clotting mechanism. Muscle system-ultra structure of muscle fibres, mechanism of muscle contraction. Nervous system, CNS and ANS; neurons; propagation of nerve impulses- synaptic transmission.

### Unit IV:

Causes and mechanisms of cell injury, reversible and irreversible injury, Introduction of hyperplasia, hypoplasia, hypertrophy, atrophy, metaplasia, necrosis and apoptosis. Tissue Renewal and Repair, healing and fibrosis, cirrhosis, congestion, haemorrhage, haemostasis, thrombosis, embolism, infarction, shock and hypertension.

### Unit V:

Aetiology and pathophysiology of diabetes, arteriosclerosis, myocardial infarction, respiratory diseases (COPD), Parkinson disease. Infectious diseases: Meningitis, Typhoid, Tuberculosis. Viral diseases- Hepatitis, COVID-19. Urinary tract infections. Advanced diagnostic techniques.

### Text books

- J.E. Hall and M.E. Hall. 2020. Guyton and Hall Text Book of Medical Physiology.
- Nancy et al., 2020. Advanced Physiology and Pathology.
- Bijlani, R.L. 2001. Fundamentals of Physiology. I edn. JayPee brothers, New Delhi
- Bipin Kumar. 2001. Human Physiology. Campus Book International, New Delhi.
- Harshmohan, 2017. Textbook of Pathology, 7th edition, Jaypee Publications
- Robbins. 2012. Text book of Pathology, 3rd edition, Elsevier Publications

### Reference Books

- B.J. Cohen and K.L. Hull. 2019. Memmler's Structure and Functions of Human Body.
- Bill Bryson. 2019. The Body- A Guide for Occupants.

- Guyton, A. C. and Hall, J. E. 2006. Textbook of Medical Physiology. 11th Edition. Saunders, Philadelphia. USA.
- Hoar W.S 2004. General and Comparative Physiology. Prentice-Hall (P) Ltd. New Delhi
- Carol Mattson Porth : 2002 Pathophysiology , VII Edition Lippincott Philadelphia.
- Vander et al's Human Physiology: The Mechanisms of Body Function; 9th Edition Eric P. Widmaier, Hershel Raff, Kevin T. Strang The Mc Graw-Hill Companies

**Course Designer:** G. Ramya vaideki

**Thiagarajar College (Autonomous):: Madurai – 625 009**  
**Department of Biotechnology**  
 (For those joined in B.Sc., Biotechnology on or after June 2020)

Course Code	Course Title	Category	L	T	P	Credit
UBT20GL41	<b>Genetics and Biostatistics &amp; Physiology and Pathology Lab</b>	Generic Elective lab 3	-	-	4	2

**L – Lecture      T – Tutorial      P- Practicals**

Year	Semester	Internal Marks	External Marks	Total Marks
II	III & IV	40	60	100

### Preamble

Acquire knowledge on problem solving in Genetics. Solve problems in measures of central tendency and dispersion. To provide the students with the basic practical knowledge on importance of each component of a biological system in performing the physiological functions.

### Course Outcomes

**On the completion of this course the student will be able to**

#	Course Outcome	Expected proficiency	Expected attainment
<b>CO1</b>	Acquire Knowledge on Mendelian Genetics	70%	68%
<b>CO2</b>	Apply knowledge of problem solving in interaction of genes	60%	58%
<b>CO3</b>	Experiment with the concepts of multiple alleles.	70%	68%
<b>CO4</b>	Analyze the excretory products from different samples, Determine the components of serum.	80%	75%
<b>CO5</b>	Determine the normal values of different clinically important biochemicals in diagnosis	80%	78%

### Mapping of COs with POs

#	PO1	PO2	PO3	PO4	PO5	PO6
<b>CO1</b>	L	M	S	L	L	S
<b>CO2</b>	L	M	L	L	L	M
<b>CO3</b>	M	L	S	L	L	M
<b>CO4</b>	L	L	L	L	L	S
<b>CO5</b>	M	M	S	S	S	S

**S (+++) – Strong      M (++) - Medium      L (+) – Low**

## Mapping of COs with PSOs

#	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	S	S	M	M
CO2	S	S	M	S	M
CO3	M	S	M	S	M
CO4	S	M	M	M	M
CO5	S	M	M	S	L

S (+++) – Strong      M (++) - Medium      L (+) – Low

## Blooms Taxonomy:

	CA		End of Semester
	First	Second	
<i>Knowledge</i>	40%	40%	40%
<i>Understand</i>	40%	40%	40%
<i>Apply</i>	20%	20%	20%

## Title of the paper: Genetics and Biostatistics lab

1. Verification of Mendelian laws (Dominance, Segregation and Independent assortment) using beads and coins
2. Preparation of Barr body
3. Demonstration of Pedigree charts of some common characters like blood group, color blindness and PTC
4. Study of Abnormal Karyotypes – Downs Syndrome (Autosomal), Turners Syndrome and Klinefelters Syndrome (Sex Chromosomal) (Pictures).
5. Problems in sex determination and sex linkage
6. Problems in linkage and three point test cross
7. Observation of Wild and Mutant forms of Drosophila – Slide.
8. Calculation of Mean , Median, Mode
9. Problem solving in Standard Deviation
10. Problems in Chi square Test

## Title of the paper: Physiology lab

1. Assessment of salivary amylase activity
2. Observation of Haemin crystals.
3. Determination of stomatal index.
4. Determination of Osmotic potential of cell sap using plasmolysis method.
5. Qualitative analysis of urine for albumin, sugar, ketone bodies and bile salts
6. Qualitative analysis excretory products –Ammonia, urea, uric acid
7. Determination of sperm count and its motility.
8. Estimation of Blood Urea
9. Quantitative analysis of glucose in serum.
10. Quantitative analysis of calcium in serum.
11. Observation of Pathology specimen- Histology slides.

**Text books:**

- Raghuvanshini R.K. 1995. Practical Exercises in Cytology, Genetics, Plant Breeding and Biostatistics. First Edition. Cbspd Publications.
- Veer Bala Rastogi.2015.Biostatistics. Third Revised Edition. Medtech.
- Robert C.Elston, William. D. Johnson. Basic Biostatistics For Geneticists and Epidemiologists .First Edition .Wiley, New York.

**Reference books:**

- Richard .D. Kowles. Solving Problems in Biostatistics. Springer, New York.
- Ghai's Textbook of Practical Physiology, VP Varshney and Mona Bedi, 2019.
- Bill Bryson. 2019. The Boday- A Guide for Occupants.
- Quantitative Human Physiology. Joseph Feher, Academic Press, 2012.
- Berne & Levy Physiology, 6th Edition, Bruce M. Koeppen and Bruce A. Stanton, Mosby, 2009.

**Course designer(s):** Dr. C. Balachandran





**B.B.A. P.O.**

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	S	M	M	S	M	S
CO2	S	L	L	S	S	S
CO3	M	M	L	M	L	S
CO4	S	M	L	S	M	M
CO5	M	L	L	M	L	S

**B.Com. P.O.**

	PO1	PO2	PO3	PO4	PO5
CO1	S	M	S	S	M
CO2	S	M	S	M	M
CO3	M	L	S	M	M
CO4	S	L	S	S	S
CO5	M	L	S	S	S

**Mapping of COs with PSOs**

#	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	S	S	M	M
CO2	M	M	S	L	M
CO3	M	S	S	M	L
CO4	S	M	S	M	M
CO5	S	M	M	M	M

S (+++) – Strong      M (++)- Medium      L (+) - Low

**Blooms Taxonomy:**

	CA		End of Semester
	First	Second	
<i>Knowledge</i>	40%	40%	40%
<i>Understand</i>	40%	40%	40%
<i>Apply</i>	20%	20%	20%

**Title of the paper: Vocational Biotechnology****Unit I:**

Organic farming technology: Globalization and organic food systems in India, Advantages of organic farming; composting - process of compost, physical and chemical analysis of compost, factors affecting composting, benefits of composting; Vermicomposting; vermiwash; preparation of panchakavya and its applications. Organic certification - guidelines, APEDA and TNOCD.

**Unit II:**

Mass cultivation and marketing management: Algalization - Spirulina; Financial management of the organic farm: Cash flow, Costing; Marketing Organic Produce: Challenges and opportunities,

Current market channels and products, Organic Symbol, Price, Market research and assessing your market, Final decision and outlets.

**Text books:**

- Dubey. R. C. 2002. A text book of biotechnology S. Chand & Co, New Delhi.
- Jon Newton, 2004. Profitable organic farming, Blackwell Science.
- Sapna E. Thottathil, India's Organic farming revolution, University of Iowa Press, Iowa City.
- Kannaiyan,S. 2002. Biotechnology of Biofertilizers. Narosa publishing house, New Delhi

**Reference books:**

- Venkataraman , L.V. and E.W. Beaker 1985. Biotechnology and utilization of algae: The Indian experience. CFTRI Mysore pp 257.
- Ann Larkin Hansen, 2010. The organic farming manual: A comprehensive guide to starting and running a certified organic farm. Storey publishing LLC.

**Course designer(s):** Dr. C. Balachandran and Dr. S. Padmavathy