

# Thiagarajar College

(An Autonomous Institution Affiliated to Madurai Kamaraj University)  
Re-Accredited with 'A' Grade by NAAC



## ***Thirty Ninth Academic Council Meeting***

## **Department of Botany and Biotechnology**

**Dr. Rm. Murugappan**  
**Dean – Curriculum Development**



**THIAGARAJAR COLLEGE, MADURAI – 9.**

**(Re-Accredited with “A” Grade by NAAC)**

**Curriculum Structure for**

B.A. Tamil, English & Economics

B.Sc., Maths, Physics, Chemistry, Botany, Biotechnology, Zoology, Microbiology and  
Psychology

**(For those who joined in 2020 and after)**

Category	Course	No. of Courses / Paper	Credit Distribution	Hrs/ Week	Total Credits
Part I	Tamil	4	3	12+12	12
Part II	English	4	3	12+12	12
		<b>Sub Total</b>		<b>48</b>	<b>24</b>
Part III	Core			72 +12	74
	Elect–Core	2	5	10	10
	Elect–Generic	2+2	5	24	20
		<b>Sub Total</b>		<b>118</b>	<b>104</b>
Part IV	<b>AECC</b> I & II Sem	I Sem EVS II Sem VE	2 + 1	2 I & II Sem	03
	<b>NME</b> III & IV Sem	2	2	2 III & IV Sem	04
	<b>SEC</b> V & VI Sem	2	2	2 V & VI Sem	04
		<b>Sub Total</b>		<b>06</b>	<b>11</b>
	<b>Total</b>				<b>139</b>
Part V	<b>NCC (Army &amp; Navy)/ PE/ NSS / Rotaract/ Quality/WSC Circle/ Library/ SSL/ Nature Club/Value Education/ YRC</b>				<b>1</b>
	<b>Grand Total</b>				<b>140</b>

AECC – Ability Enhancement Compulsory Course

SEC – Skill Enhancement Course

NME – Non Major Elective

For Choice Based Credit System (CBCS)

- For NME every department offers two papers (one in each at III & IV Semester)
- For SEC every department offers two papers for each course (in Sem V & VI)
- For Major elective there may be an option for choice.

Semester	Courses
<b>I</b>	<b>EVS</b>
<b>II</b>	<b>VE</b>
<b>III</b>	<b>NME</b>
<b>IV</b>	<b>NME</b>
<b>V</b>	<b>SEC</b>
<b>VI</b>	<b>SEC</b>



# **B.Sc. Botany**

**Programme Code : UBO**



## **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.





# ***B.Sc., Botany***

## **Vision**

Provision of knowledge to contribute towards the sustainable utilization of Plant Biosphere

## **Mission**

- To foster an environment of excellence by providing a comprehensive set of courses in plant sciences that enhances the understanding, depth of knowledge and technical competency of the students.
- To provide the students competence for entry-level research and teaching positions in biological sciences.
- To inculcate the students with an environment that fosters the development of appropriate scientific vocabulary, reasoning skills, and effective oral and written communication abilities for students.
- To create a holistic understanding of the allied subjects through interdisciplinary learning.

## **Programme Educational Objectives (PEO)**

The objectives of B.Sc., Programme is to prepare and further to equip the Graduates of Botany

<b>PEO1</b>	To develop a strong and competent knowledge in basic Plant Sciences, required for critical learning and to create attitude on research.
<b>PEO2</b>	To develop diversified basic professional skills through various laboratory technical training, communication and presentation skills
<b>PEO3</b>	To make them to possess an ability to identify, formulate, and solve problems, related to the subject of Botany and to facilitate them towards community service, by utilizing the professional and private realm
<b>PEO4</b>	To integrate related topics from the course components such as Plant Organization, Techniques related to Taxonomy, Ecology, Anatomy, Cell Biology, Biochemistry, Physiology, Genetics, Embryology, Evolution, Basic Biotechnology and Molecular Biology for their successful career.
<b>PEO5</b>	To create them to be proficient in applying their knowledge to analyze the scope of plant science and address scientifically controversial issues in a rational way

## **Programme specific outcomes- B.Sc., Botany**

On successful completion of B.Sc. Botany Programme, the students will be able to

<b>PSO1</b>	Identify various plant life forms, using specific identification key characteristic features
<b>PSO2</b>	Demonstrate the acquired knowledge and to comprehend the core concepts of Botany at organizational (both external morphology, internal morphology), cellular, and molecular levels through which the developmental and physiological functioning of plants
<b>PSO3</b>	Show their skills in practical work, experiments, use of biological tool and techniques, further to orient their attitude towards research
<b>PSO4</b>	Explore various life forms and their intricacies of at the cellular and molecular level
<b>PSO5</b>	Expertise in statistical analyses of data for better interpretations and problem solving

**THIAGARAJAR COLLEGE, MADURAI – 9.**  
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**DEPARTMENT OF BOTANY**  
**Bachelor of Science (B.Sc.,) Botany (w.e.f. 2020 batch onwards)**  
**Programme Code-UBO**  
**Programme Scheme**  
**SEMESTER –I**

Course	Code No	Subject	Hrs/ Week	Cred.	Total Hrs	Max Mark CA	Max Marks SE	Total
Part I	U20P111	Tamil	6	3	90	25	75	100
Part II	U20EN11	English	6	3	90	25	75	100
Core 1	UBO20C11	Algae and Bryophytes	3	3	45	25	75	100
Core 2	UBO20C12	Mycology and Plant Pathology	3	3	45	25	75	100
Core Lab 1	UBO20CL11	Algae, Bryophytes Mycology and Plant Pathology Lab	4	2	60	40	60	100
Generic Elective 1	UZO20GE11B	Economic Zoology	4	4	60	25	75	100
Generic Elective 1 Lab	UZO20GL21B	Economic Zoology Lab I	2	-	30			
AECC I	U20ES11	EVS	2	2	30	15	35	50
<b>TOTAL</b>			<b>30</b>	<b>20</b>	450	180	470	650

**Semester – II**

Course	Code No	Subject	Hrs/ Week	Cred	Total Hrs	Max Mark CA	Max Marks SE	Total
Part I	U20P121	Tamil	6	3	90	25	75	100
Part II	U20EN21	English	6	3	90	25	75	100
Core 3	UBO20C21	Pteridophytes, Gymnosperms and Paleobotany	3	3	45	25	75	100
Core 4	UBO20C22	Cell Biology	3	3	45	25	75	100
Core Lab 2	UBO20CL21	Pteridophytes, Gymnosperms and Paleobotany and Cell biology Lab	4	2	60	40	60	100
Generic Elective 1	UZO20GE21B	Insect pest management	4	4	60	25	75	100
Generic Elective 1 Lab	UZO20GL21B	Insect pest mgmt. lab	2	-	30			
Practical Examination for Generic Elective 1				2		40	60	100
AECC II	U20VE21	VE	2	1	30	15	35	50
<b>TOTAL</b>			<b>30</b>	<b>21</b>	450	<b>235</b>	<b>515</b>	750

### Semester – III

Course	Code No	Subject	Hrs/Week	Cred	Total Hrs	Max Mark CA	Max Marks SE	Total
Part I Tamil	U20P131	Tamil	6	3	90	25	75	100
Part II English	U20EN31	English for Comm. III	6	3	90	25	75	100
Core 5	UBO20C31	Plant Anatomy and Embryology	4	4	60	25	75	100
Core 6	UBO20C32	Bioinstrumentation and Computer applications	4	4	60	25	75	100
Core Lab 3	UBO20CL31	Plant Anatomy and Embryology Lab	2	1	30	40	60	100
Generic Elective 2	UCH20GE31B	Chemistry Paper I	4	4	60	25	75	100
Generic Elective 2 Lab	UCH20GL31B	Chemistry paper I Lab	2	--	30			
NME1	UBO20NE31	Horticulture	2	2	30	15	35	50
<b>TOTAL</b>			<b>30</b>	<b>21</b>	<b>450</b>	<b>180</b>	<b>470</b>	<b>650</b>

### Semester – IV

Course	Code No	Subject	Hrs/Week	Cred	Total Hrs	Max mark CA	Max Mark SE	Total
Part I Tamil	U20P141	Tamil	6	3	90	25	75	100
Part II English	U20EN41	English for Comm. IV	6	3	90	25	75	100
Core 7	UBO20C41	Microbiology	4	4	60	25	75	100
Core 8	UBO20C42	Herbs and drugs	4	4	60	25	75	100
Core Lab 4	UBO20CL41	Microbiology Lab	2	1	30	40	60	100
Generic Elective 2	UCH20GE41	Chemistry Paper II	4	4	60	25	75	100
Generic Elective 2 Lab	UCH20GEL41	Chemistry paper II Lab	2		30			
Practical Examination for Generic Elective 2				2		40	60	100
NME2	UBO20NE41	Mushroom Cultivation	2	2	30	15	35	50
<b>Total</b>			<b>30</b>	<b>23</b>	<b>450</b>	<b>235</b>	<b>565</b>	<b>800</b>

**Semester – V**

Course	Code No	Subject	Hrs/Week	Cred	Total Hrs	Max Mark CA	Max Marks SE	Total
Core 9	UBO20C51	Morphology and Taxonomy of Angiosperms	4	4	60	25	75	100
Core 10	UBO20C52	Plant Biochemistry	4	4	60	25	75	100
Core 11	UBO20C53	Genetics, Evolution and Biostatistics	3	3	45	25	75	100
Core 12	UBO20C54	Biofertilizers and Organic farming	3	3	45	25	75	100
Core Lab 5	UBO20CL51	Morphology and Taxonomy of Angiosperms Lab	3	2	45	40	60	100
Core Lab 6	UBO20CL52	Plant Biochemistry Lab	3	2	45	40	60	100
Core Lab 7	UBO20CL53	Genetics, Evolution and Biostatistics Lab	3	2	45	40	60	100
M elective1	UBO20CE51 (A/B)	Horticulture and Plant Breeding / Nutraceuticals	5	5	75	25	75	100
SEC 1	UBO20SE51 (A/B/C)	Histology and staining techniques/ Mushroom Technology/ Bioremediation	2	2	30	15	35	50
<b>Total</b>			<b>30</b>	<b>27</b>	<b>450</b>	<b>260</b>	<b>590</b>	<b>850</b>

**Semester – VI**

Course	Code No	Subject	Hrs/Week	Cred	Total Hrs	Max Mark CA	Max Marks SE	Total
Core 13	UBO20C61	Plant Physiology	4	4	60	25	75	100
Core 14	UBO20C62	Plant Biotechnology	4	4	60	25	75	100
Core 15	UBO20C63	Plant Ecology and Biodiversity	3	3	45	25	75	100
Core 16	UBO20C64	IPR and Biosafety	3	3	45	25	75	100
Core Lab 8	UBO20CL61	Plant Physiology Lab	3	2	45	40	60	100
Core Lab 9	UBO20CL62	Plant Biotechnology Lab	3	2	45	40	60	100
Core lab 10	UBO20CL63	Plant Ecology and Biodiversity Lab	3	2	45	40	60	100
M Elective2 (theory)	UBO20CE61 (A/B)	Basics of Molecular Biology/ Plant resources and Utilization	5	5	75	25	75	100
SEC 2	UBO20SE61(A)/ UBO20SE61(B)	Seed and nursery Technology/ Sea weed Technology/ Biopesticides	2	2	30	15	35	50
<b>TOTAL</b>			<b>30</b>	<b>27</b>	<b>450</b>	<b>260</b>	<b>590</b>	<b>850</b>
<b>TOTAL CREDITS FOR SEMESTERS I to VI</b>				<b>139</b>	<b>(20 + 21 + 21 + 23 + 27 + 27)</b>			
<b>PART V</b>				<b>01</b>				
<b>Total Credits for B.Sc. programme</b>				<b>140</b>				

Generic Elective offered to B.Sc. Zoology students

Course	Code No	Subject	Hrs/Week	Cred.	Total Hrs	Max Mark CA	Max Marks SE	Total
<b>SEMESTER III</b>								
GE2	UBO20GE31Z	Plant Life forms	4	4	60	25	75	100
	UBO20GL41Z	Plant Life forms Lab	2	-	30	-	-	-
<b>SEMESTER IV</b>								
GE2	UBO20GE41Z	Plant Pathology	4	4	60	25	75	100
	UBO20GL41Z	Plant Pathology Lab	2	2	30	40	60	100

A) Consolidation of contact hours and credits: UG

Semester	Contact Hours/Week	Credits
I	30 hrs	20
II	30 hrs	21
III	30 hrs	21
IV	30 hrs	23
V	30 hrs	27
VI	30 hrs	27
PART - V	--	01
Total		140

B) Curriculum Credits: Part wise

		No of Courses	Credits per Course	Total Credits
PART I	Tamil	04	3	12
PART II	English	04	3	12
PART III	Core Theory	16	3/4	56
	Core Lab	10	1/2	18
	Core Elective	02	5	10
	Generic Elective Theory	04	4	16
	Generic Elective Lab	02	2	04
PART IV	Ability Enhancement Compulsory Course	02	2+1	03
	Non Major Elective	02	2	04
	Skill Enhancement Course	02	2	04
Total		49		139
PART V	(NSS/NCC/Physical Education)			01
	<b>GRAND TOTAL</b>			140

**Mapping Courses Against POs  
B.Sc., Botany Programme**

		<b>COURSE TITLE</b>	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	
<b>YEAR I</b>	<b>SEMESTER I</b>	Algae and Bryophytes	S						
		Mycology and Plant Pathology	S						
		Algae, Bryophytes Mycology and Plant Pathology Lab	S		S	S			
	<b>SEMESTER II</b>	AECC1 - EVS		S				S	
		GE1 Course 1 Zoology	S						
		GE1 Course 1 Zoology Lab	S						
<b>YEAR II</b>	<b>SEMESTER III</b>	Pteridophytes, Gymnosperms and Paleobotany	S						
		Cell Biology	S	S					
		Pteridophytes, Gymnosperms and Paleobotany and Cell Biology Lab	S		S	S			
	<b>SEMESTER IV</b>	AECC2 – VE		S				S	
		GE1 Course 2 Zoology	S						
		GE1 Course 2 Zoology Lab	S						
<b>YEAR III</b>	<b>SEMESTER V</b>	Plant Anatomy and Embryology	S			S	S	S	
		Bioinstrumentation and Computer applications	S						
		Plant Anatomy and Embryology Lab	S	S		S	S	S	
	<b>SEMESTER VI</b>	GE2 Course 1 Chemistry	S						
		GE2 Course 1 Chemistry Lab	S	S					
		Non Major Elective -1							
<b>YEAR III</b>	<b>SEMESTER I</b>	Microbiology	S	S	S		S	S	
		Herbs and Durgs	S			S		S	
		Microbiology Lab	S	S	S			S	
	<b>SEMESTER II</b>	GE2 Course 2 Chemistry	S						
		GE2 Course 2 Chemistry Lab	S						
		Non Major Elective -2							
	<b>SEMESTER III</b>	Skill Based Elective 1 Bioremediation/ Biopesticides	S				S	S	S
		Morphology and Taxonomy of Angiosperms	S	S					
		Plant Biochemistry	S	S		S	S		
		Genetics, Evolution and Biostatistics	S	S	S	S			
		Biofertilizers and Organic farming	S	S		S			S
		Morphology and Taxonomy of Angiosperms Lab	S	S	S				S
<b>SEMESTER IV</b>	Plant Biochemistry Lab	S	S	S				S	
	Genetics, Evolution and Biostatistics Lab	S	S	S			S	S	
	Core Elective 1	S	S				S		
	Horticulture and Plant Breeding/ Nutraceuticals								
	Skill based Elective 2	S	S				S		
	Histology and staining techniques/ Mushroom Technology								
<b>SEMESTER V</b>	Plant Physiology	S	S						
	Plant Biotechnology	S	S				S		
	Plant Ecology and Biodiversity	S	S					S	
	IPR and Biosafety	S	S		S	S	S	S	
	Plant Physiology Lab	S	S	S					
	Plant Biotechnology Lab	S	S	S			S		
<b>SEMESTER VI</b>	Plant Ecology and Biodiversity Lab	S	S	S				S	
	Core Elective 2 Basics of Molecular Biology/	S					S		
	Plant resources and Utilisation								
	Skill Based Elective 3	S					S	S	
	Seed and nursery Technology/ Sea weed Technology								

**Mapping Courses Against PSOs  
B.Sc., Botany Programme**

	<b>COURSE TITLE</b>	<b>PSO1</b>	<b>PSO2</b>	<b>PSO3</b>	<b>PSO4</b>	<b>PSO5</b>
<b>YEAR I</b>	<b>SEMESTER I</b>					
	Algae and Bryophytes	S				
	Mycology and Plant Pathology	S				
	Algae, Bryophytes Mycology and Plant Pathology Lab	S		S	S	
	AECC1 - EVS		S			S
	GE1 Course 1 Zoology	S				
<b>YEAR II</b>	<b>SEMESTER II</b>					
	GE1 Course 1 Zoology Lab	S				
	Pteridophytes, Gymnosperms and Paleobotany	S				
	Cell Biology	S	S	S	S	
	Pteridophytes, Gymnosperms and Paleobotany and Cell Biology Lab	S		S	S	
	AECC2 – VE					S
<b>YEAR III</b>	<b>SEMESTER III</b>					
	GE1 Course 2 Zoology	S				
	GE1 Course 2 Zoology Lab	S				
	Plant Anatomy and Embryology	S			S	S
	Bioinstrumentation and Computer applications	S				S
	Plant Anatomy and Embryology Lab	S	S		S	S
	<b>SEMESTER IV</b>					
	GE2 Course 1 Chemistry	S				
	GE2 Course 1 Chemistry Lab	S	S			
	Non Major Elective -1					
	Microbiology	S	S	S		S
	Herbs and Durgs	S	S			
<b>YEAR III</b>	<b>SEMESTER V</b>					
	Microbiology Lab	S	S	S		
	GE2 Course 2 Chemistry	S				
	GE2 Course 2 Chemistry Lab	S				
	Non Major Elective -2					
	Skill Based Elective 1 Bioremediation/ Biopesticides	S				S
	Morphology and Taxonomy of Angiosperms	S	S			
	Plant Biochemistry	S	S		S	S
	Genetics, Evolution and Biostatistics	S	S	S	S	
	Biofertilizers and Organic farming	S	S	S		
	Morphology and Taxonomy of Angiosperms Lab	S	S	S		
	Plant Biochemistry Lab	S	S	S		
Genetics, Evolution and Biostatistics Lab	S	S	S		S	
<b>SEMESTER VI</b>						
Core Elective 1	S	S			S	
Horticulture and Plant Breeding/ Nutraceuticals						
Skill based Elective 2	S	S			S	
Histology and staining techniques/ Mushroom Technology						
Plant Physiology	S	S				
Plant Biotechnology	S	S			S	
Plant Ecology and Biodiversity	S	S				
IPR and Biosafety	S		S	S	S	
Plant Physiology Lab	S	S	S			
Plant Biotechnology Lab	S	S	S		S	
Plant Ecology and Biodiversity Lab	S	S	S			
Core Elective 2 Basics of Molecular Biology/ Plant resources and Utilisation	S				S	
Skill Based Elective 3	S				S	
Seed and nursery Technology/ Sea weed Technology						

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

Course Code	Course Title	Category	L	T	P	Credit
UBO20C11	Algae and Bryophytes	Core-1	3	-	-	3

L - Lecture                      T - Tutorial                      P - Practicals

Year	Semester	Int. Marks	Ext. Marks	Total
First	I	25	75	100

### Preamble

To make the students aware of lower groups of life forms with their significance

### Course Outcomes

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

#	Course Outcome	Knowledge Level
CO1	Name the various kinds of primitive, aquatic life forms and their structural features	K1
CO2	Identify the structural adaptations of marine algae	K2
CO3	Explore the life cycle patterns of algae and realize the economic significance of algae	K3
CO4	Relate the external and internal structural changes of amphibious plants with their habitats	K1
CO5	Show the variations in gametophyte structure and realize the economic significance of bryophytes	K1

K1 - Knowledge

K2 - Understand

K3 - Apply

### Mapping of COs with POs

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

Strong(S)

Medium(M)

Low(L)

### Mapping of COs with PSOs

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



## 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%

## Course Title: Algae and Bryophytes

**Unit I:** General classification of Algae based on Fritsch(1945) system – General characters of Blue-green Algae- *Nostoc* – Occurrence – Structure – Heterocyst structure and function – Reproduction – Vegetative reproduction – Asexual reproduction – Hormogones, Endospores and Akinetes- Life cycle of *Nostoc. Oedogonium* - Occurrence, external and internal structure, reproduction and life cycle

**Unit II:** General characters of Green algae – *Caulerpa* – Thallus structure – Internal structure – Reproduction – Vegetative reproduction – Sexual reproduction – Diplontic Life cycle. General characters of Brown algae – *Padina* – Occurrence – Thallus structure – Internal structure - Reproduction – Vegetative, asexual and sexual reproduction – Isomorphic Diplohaplontic Life cycle of *Padina*.

**Unit III:** General characters of Red algae - *Gracilaria* – Occurrence – Thallus structure – Cell structure- Reproduction – Vegetative, asexual and sexual reproduction –Life cycle of *Gracillaria*. Economic importance of Algae.

**Unit IV:** General classification of Bryophytes based on Rothmaler(1951) – *Marchantia* – Occurrence – external features of adult gametophyte – Internal structure – Reproduction – Asexual reproduction – structure of Gemma – Sexual reproduction – structure of Antheridiophore and Archegoniophore – Sporophyte structure – Life cycle. (Development of sex organs excluded).

**Unit V:** Occurrence – external features of adult gametophyte – Internal structure – Reproduction – Asexual reproduction – Sexual reproduction – Sporophyte structure – Life cycle of *Anthoceros and Funaria* (Development of sex organs excluded). Economic Importance of Bryophytes.

### Text Books:

1. Vashishta, B R., Singh, V. P. and Sinha, A. K .2012. Botany for Degree Students, S. Chand Publishers, Chennai
2. Lynda Ed. West. 2010. Algae, Cambridge University Press, UK.
3. Vashishta, B.R. 1988. Bryophyta, 6<sup>th</sup> Edition, S. Chand and company, (Pvt.) Ltd., New Delhi.
4. Kumar, H.D. 1990. Introductory Phycology, Affiliated East West Press (P) Ltd., New Delhi.
5. Rashid, A. 1998. An introduction to Bryophyta, Vikas Publishing House (P) Ltd., New Delhi.

### Reference Books:

1. Tuba, Z., N.G., Sleck and L.R. Stark. 2011. Bryophyte, Cambridge University Press, UK.

### Web Sources:

1. <https://www.plantscience4u.com/2014/04/fritsch-classification-of-algae.html#.XnhVix8zBIU>
2. <https://www.legit.ng/1111992-economic-importance-algae.html>
3. <http://bryophytes.plant.siu.edu/bryojustified.html>
4. <https://www.toppr.com/guides/biology/plant-kingdom/bryophytes/>

**Course Designer: Dr. K. Saraswathi**

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

Course Code	Course Title	Category	L	T	P	Credit
UBO20C12	Mycology and Plant Pathology	Core-2	3	-	-	3
			L - Lecture	T - Tutorial	P - Practicals	
Year	Semester	Int. Marks	Ext. Marks	Total		
First	I	25	75	100		

### Preamble

To familiarize the students with unique group of plants namely Fungi and Plant diseases with their control measures

### Course Outcomes

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

#	Course Outcome	Knowledge Level
CO1	State the structure and reproduction of different groups of fungi	K1
CO2	Recognize the economic importance and symbiotic relationship of fungi	K2
CO3	Relate the plant infection and defense mechanism	K1
CO4	Identify the plant disease based symptoms	K2
CO5	Demonstrate the plant disease control methods	K3

K1 - Knowledge

K2 - Understand

K3 - Apply

### Mapping of COs with POs

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

Strong(S)

Medium(M)

Low(L)

### Mapping of COs with PSOs

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

## 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%

## Course Title: Mycology and Plant Pathology

**Unit I:** General characters of Fungi - Classification of Fungi based on Alexopoulos and Charles W.Mims system (1979) - General Characters of Zygomycetes, Ascomycetes and Basidiomycetes. Structure, reproduction and life cycle of *Rhizopus*, *Aspergillus* and *Agaricus*.

**Unit II:** General characters of Deuteromycetes. Occurrence, vegetative structure, Asexual reproduction of *Fusarium*- Economic importance of Fungi- Lichens: Morphology of the thallus – crustose, foliose, and fruticose types, Fungal and Algal components, symbiosis, vegetative reproduction: Fragmentation, Isidia and Soredia, sexual reproduction, Apothecium, Lichen as pollution indicators- Economic importance of Lichens.

**Unit III:** Plant pathology: Introduction, history, Importance - Pathogen: penetration, infection, invasion, and dispersal – plant defense mechanism: structural and biochemical, enzymes, and toxins - Epidemiology: forms, progressive severity of epidemics and decline of epidemics - Recent methods of plant disease forecasting.

**Unit IV:** Symptomatology – Study about the symptoms, manifestation and disease control measures of the following diseases

1. Citrus canker,
2. Fire blight of grapes,
3. Tikka disease of groundnut
4. Cucumber Mosaic virus
5. Smut of Sorghum
6. Red rot of Sugar cane
7. Phyllody of drumstick.

**Unit V:** Plant quarantine concepts and principles- Crop rotation, soil treatment, Seed treatment - Disease control strategies - physical, Chemical, Genetic and biological control - Engineered resistance against bacterial, fungal and viral pathogens.

### Text Books:

1. Vashishta, B.R. and Sinha, A.K. 2010. Botany for Degree Students - Fungi, S.Chand & Company Ltd., New Delhi.
2. Ananthanarayanan, R. and C.K. JayaramPaniker. 1996. Text book of Microbiology. Orient Longman, Hyderabad.
3. Aneja, K.R. 1996. Experiments in Microbiology, Plant pathology, Tissue culture and Mushroom Cultivation. VishwaPrakashan (New Age International (p) Ltd.) New Delhi.
4. Rangaswamy, G. 1975. Diseases of crop plants in India. 2nd Edn. Prentice Hall, India Books.
5. Pandey, B.P 1997. Plant pathology. S.Chand and Co. Ltd., New Delhi.
6. Mehrotra, R.S. 1980. Plant pathology, Tata McGraw Hill Publishing Company Ltd., New Delhi.

**Reference Books:**

1. Dube, H.C. 2009. Introduction to Fungi, Vikas publishing Pvt. Ltd., New Delhi.
2. Paracer, S and V.Ahmadjian. 2002. Symbiosis, Oxford University Press, Chennai.
3. West, G.S. 2010. Algae Vol. I. Myxophyceae, Peridinieae, Bacillariaceae, Chlorophyceae, Cambridge Botanical hand book series, UK.
4. Agrios, G.N.2006. Plant pathology, Fifth edition, Academic Press, New York.
5. Singh, R.S. 2009. Plant Diseases, Oxford & IBH Publishing Co.Pvt. Ltd., New Delhi.

**Web Sources:**

- <https://www.plantscience4u.com/2014/04/fritsch-classification-of-algae.html#.XnhVix8zbIU>  
<https://www.legit.ng/1111992-economic-importance-algae.html>  
<http://bryophytes.plant.siu.edu/bryojustified.html>  
<https://www.toppr.com/guides/biology/plant-kingdom/bryophytes/>  
<https://www.saferbrand.com/advice/plant-disease-library>  
<https://www.proflowers.com/blog/plant-diseases>

**Course Designers:**

1. **Dr. V. Karthikeyan**
2. **Dr. K. Saraswathi**

**Thiagarajar College (Autonomous):: Madurai – 625 009**

**Department of Botany**

(For those joined B.Sc., Botany on or after June 2020)

**Programme Code : UBO**

Course Code	Course Title	Category	L	T	P	Credit
UBO20CL11	<b>Algae and Bryophytes, Mycology and Plant Pathology Lab</b>	<b>Core Lab-1</b>	-	-	4	2

Year	Semester	Int. Marks	Ext.Marks	Total
First	First	40	60	100

**Preamble**

To make the students to identify lower group of plants based on morphology and anatomy

**Course Outcomes**

On the completion of the Algae and Bryophytes, Mycology and Plant Pathology lab course the student will be able to

#	Course Outcome	Knowledge Level
<b>CO1</b>	Identify algae and bryophytes based on their morphology	K1
<b>CO2</b>	Distinguish the life forms at generic level based on anatomical variations	K2
<b>CO3</b>	Recognize the morphological and anatomical variations of marine forms	K2
<b>CO4</b>	Equipped with micro preparation of tender thallus	K3

**K1 – Knowledge**

**K2 – Understand**

**K3 – Apply**

**Mapping of COs with POs**

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

**Strong(S), Medium(M), Low(L)**

**Mapping of Course Outcomes with Programme Specific Outcomes**

	<b>PSO1</b>	<b>PSO2</b>	<b>PSO3</b>	<b>PSO4</b>	<b>PSO5</b>
<b>CO1</b>	S	S	L	M	L
<b>CO2</b>	S	S	S	S	L
<b>CO3</b>	S	S	M	M	L
<b>CO4</b>	M	S	S	S	L

**S-Strong M-Medium**

**L-Low**

### **Algae and Bryophytes**

1. Cyanophyceae - Identification of *Nostoc* from fresh water samples and Study of filament structure.
2. Chlorophyceae- Study of *Oedogonium* filament and reproductive cells using permanent slides.
3. Chlorophyceae- Study of Morphological and anatomical features of *Caulerpa*
4. Phaeophyceae- *Padina* - Study of Morphology and anatomy of macroscopic gametophytic thallus, gametangium and tetrasporophytic thallus.
5. Rhodophyceae – *Gracilaria*- gametophyte, sporophyte and cystocarp
6. Hepaticopsida- Study of external and internal structure of *Marchantia* thallus.
7. Anthocerotopsida - Study of external and internal structure of *Anthoceros* thallus using permanent slides
8. Bryopsida- Study of external and internal structure of *Funaria* gametophyte. L.S. of Capsule

### **Mycology and Plant Pathology**

1. Zygomycetes- Micropreparation and Study of *Rhizopus* sporangiophore
2. Ascomycetes- Micropreparation and Study of *Aspergillus* conidiophore
3. Basidiomycetes- Study of Morphological and anatomical features of *Agaricus*
4. Deuteromycetes- Micropreparation and study of, *Fusarium* conidia.
5. Foliose and Fruticose Lichens- Study of Morphology of *Parmelia* and *Usnea*;
6. L.S. of Lichen Apothecium

Study of the following diseased plant materials

7. Citrus Canker
8. Tikka Disease of Groundnut
9. Smut of Sorghum
10. Red rot of Sugarcane
11. Demonstration of the isolation of pathogen from diseased material.
12. Submission of 5 herbarium sheets of infected plant materials –Valued externally.

### **Course Designers**

1. Dr. V. Karthikeyan
2. Dr. K. Saraswathi

**Thiagarajar College (Autonomous):: Madurai – 625 009**  
**Department of Botany**  
 (For those joined B.A., B.Sc., B.Com., B.B.A., B.C.A on or after June 2020)  
**Programme Code : UBO**

Course Code	Course Title	Category	L	T	P	Credit
U20ES11	Environmental Studies	AECC1	2	-	-	2

Year	Semester	Int. Marks	Ext.Marks	Total
First	First	15	35	50

### Preamble

Students acquire knowledge on the basic concepts, components and importance of environment.

### Course Outcomes

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

	Course outcomes	Knowledge Level
CO1	Define the structure and functions of ecosystem	K1
CO2	Explain the benefits of biodiversity conservation	K2
CO3	Summarise the sources, effects and control measures of various types of Pollutant and pollutants	K1
CO4	Perceive the environment legislations in India for sustainable development.	K3
CO5	Elaborate the impact of environmental problems on life systems	K3

**K1: Knowledge K2: Understand K3: Apply**

### Mapping of Course Outcomes with Programme Specific Outcomes

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

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

### Mapping of Course Outcomes with Programme Outcomes

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

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

## Blooms taxonomy: Assessment Pattern

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

## Course Title: Environmental Studies

### Unit I

Definition and Scope of Environmental Studies – Ecology and Ecosystem – Structure of an Ecosystem – Food chains, food webs and ecological pyramids – Causes of Biodiversity Loss – Benefit and Conservation of Biodiversity

### Unit II

Environmental problems and Management: Causes, effects and Control measures of : Air Pollution – Water Pollution – Noise pollution – Nuclear Hazards. Solid waste management and Waste Disposal methods. Climate change and Global Warming causes and Measures. Waste and Plastics. Urban environmental problems and measures. Environmental Legislations in India. Sustainable development and Inclusive growth.

### Text Book

1. Kanagasabai, C.S. 2005. Environmental Studies. Rasee publishers. Madurai.

### Reference Books

1. Yogendra, N. and Srivastava, N. 1998. Environmental Pollution, Ashish Publishing House. New Delhi.
2. Sapru R.K. 2001. Environment Management in India, Vol. I & Vol. II Ashish publishers house, New Delhi.



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

Course Code	Course Title	Category	L	T	P	Credit
UBO20C21	<b>Pteridophytes, Gymnosperms and Palaeobotany</b>	<b>Core-3</b>	<b>3</b>	<b>-</b>	<b>-</b>	<b>3</b>

L - Lecture                      T - Tutorial                      P - Practical's

Year	Semester	Int. Marks	Ext. Marks	Total
<b>First</b>	<b>II</b>	<b>25</b>	<b>75</b>	<b>100</b>

**Preamble**

To render the facts about first vascular plants and first flowering plants

**Course Outcomes**

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

#	Course Outcome	Knowledge Level
<b>CO1</b>	Specify the types and structural adaptations of first vascular plants	K1
<b>CO2</b>	Elucidate the diversity and complexity of first group of land plants	K3
<b>CO3</b>	Outline the structural and reproductive specialization of seed plants	K1
<b>CO4</b>	Discover commercially important phytochemicals found in first seed plants	K3
<b>CO5</b>	Describe the types and formation of fossils, their origin, structural features	K2

K1 - Knowledge

K2 - Understand

K3 - Apply

**Mapping of COs with POs**

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

Strong(S), Medium(M), Low(L)

**Mapping of COs with PSOs**

	PSO1	PSO2	PSO3	PSO4	PSO5
<b>CO1</b>	S	S	S	S	L
<b>CO2</b>	S	S	S	S	L
<b>CO3</b>	S	S	S	S	L
<b>CO4</b>	S	S	S	S	L
<b>CO5</b>	S	S	S	S	L

Strong(S), Medium(M), Low(L)

## 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%

## Course Title: Pteridophytes, Gymnosperms and Palaeobotany

(Development of sex organs excluded in all the form studies)

**Unit I:** General characteristic features of Pteridophytes - Classification of Pteridophytes by Smith (1955) - General characteristic features of Psilopsida – *Psilotum*: habitat, distribution, external structure, internal structure and reproduction - General characteristic features of Lycopsidea – *Lycopodium*: external structure, internal structure, reproduction

**Unit II:** General characteristic features of Sphenopsida - *Equisetum*: habitat, distribution, external structure, internal structure and reproduction - General characteristic features of Pteropsida –*Marsilea*: Habitat, distribution, external structure, internal structure and reproduction – types of Sporangium development (Lepto and Eusporangiate)-Stelar evolution in pteridophytes -Economic importance of Pteridophytes.

**Unit III:** General characteristic features of Gymnosperms - Classification of Gymnosperms by Sporne (1962) - General characteristic features of Cycadopsida – *Cycas*: Habitat, distribution, external structure, internal structure and reproduction - General characteristic features of Coniferopsida - *Pinus*: habitat, distribution, external structure, internal structure and reproduction.

**Unit IV:** General characteristic features of Gnetopsida – *Gnetum*: habitat, distribution, external structure, internal structure and reproduction - Economic importance of Gymnosperms: Food, Fodder, Timber, Ornamentals, Medicine and Fuel for energy, fossil fuels.

**Unit V:** Paleobotany - Geological time scale - brief account on process of fossilization - Fossil types - Structure of *Rhynia* and *Lepidodendron*.

### Text Books:

1. Vashishta, P.C.andSinha,A.K. 2013. Gymnosperms, S.Chand and Co., New Delhi.
2. Pandey, B.P. 2001. College Botany, Vol.II, S.Chand and Co., New Delhi.
- 3.Sambamurthy, A.V.S.S. 2005. Gymnosperms and Palaeobotany. I.K. International Pvt.Ltd., New Delhi

### Reference Books:

1. Smith.A.R., 1981. Pteridophytes, California Academy of Sciences. California.
2. Reddy, S.M. and S.J. Chary. 2003. Gymnosperms, New age international (p) Ltd. Publisher New Delhi.
3. Spiler, R. A. and B.A. Thomas, 1986. Systematics & Taxonomic approaches in Paleobotany, Clarendon Press, UK.

### Course designer

1. Dr. K.Saraswathi

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

Course Code	Course Title	Category	L	T	P	Credit
UBO20C22	Cell Biology	Core - 4	3	-	-	3

L - Lecture                      T - Tutorial                      P - Practical's

Year	Semester	Int. Marks	Ext. Marks	Total
First	II	25	75	100

### Preamble

To make acquainted the structure of plant tissues, organelles, and its functions

### Course Outcomes

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

#	Course Outcome	Knowledge Level
CO1	Explain the basic unit of plant and animal system	K1
CO2	Elucidate the different organelle exist in plants	K2
CO3	Reveal the stages of cell cycle	K2
CO4	Examine the different stages of mitotic and meiotic cell divisions	K3
CO5	Utilize the microscopes to identify structural details of cells	K3

K1 - Knowledge      K2 - Understand      K3 - Apply

### Mapping of COs with POs

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

Strong(S), Medium (M), Low (L)

### Mapping of COs with PSOs

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

S: Strong      M: Medium      L: Low

## Blooms taxonomy

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

## Course Title: Cell Biology

### Unit I:

Cell biology; History of cell biology – Prokaryotic and Eukaryotic cell - Plant and animal cell - Structure of plant cell –ultra structure - structure and functions of cell wall, Plasma membrane –Fluid mosaic model. Cytosol –cytoskeleton organization.

### Unit II:

Structure and function of cytoplasmic organelles - Endoplasmic reticulum – Peroxisomes –Lysosomes – Vacuoles – Ribosome – Golgi apparatus- Ergastic substances.

### Unit III:

Mitochondria – structure and function – Plastids – types - Chloroplast – structure and function - Nucleus –structure and function - Structure and types of chromosome – Euchromatin – Heterochromatin – Special types of chromosome – Lampbrush and Polytene.

### Unit IV:

Cell cycle – phases, events and check points and regulation. Cell Division -- Amitosis, Mitosis and Meiosis- significance .

### Unit V:

Techniques in Cell Biology: Microscopy-Principles, Instrumentation and uses of Light microscope, SEM and TEM. Microtome. Camera Lucida. Squash and Smear preparations. Karyotyping .

### Text Books:

- 1.Verma P.S. and V. K. Agarwal, 2006. Cytology, S. Chand and Co. Ltd., New Delhi.
- 2.Pandey, B.P. 2010. Plant Anatomy, S. Chand and Co. Ltd., New Delhi.
3. Powar, C.B. 2009. Cell Biology. Himalayan Publishing House, New Delhi.

### Reference Books:

- 1.Becker, W.M., L.J. Kleinsmith and J. Hardin, 2011. The World of the Cell, Dorling Kindersley (India) Pvt. Ltd., New Delhi.
- 2.Fahn, A. 1990. Plant Anatomy, Pergman press, Oxford, London.
3. Alberts, B. et al., 1994. Molecular Biology of the Cell (3rd edition). Garland Publishing, Inc., New York
4. De Robertis E.D.P and E.M.F.DeRobertis. 2011. Cell and Molecular Biology. (8<sup>th</sup> edition). B.I. Publications Pvt. Ltd., India

### Web Sources:

- <https://youtu.be/URUJD5NEXC8>  
<https://youtu.be/ZyWYID2cTK0>  
<https://youtu.be/Q6ucKWIIIFmg>  
<https://youtu.be/8H0q7H1zVEw>

### Course Designer:

Dr. E. Mohan

**Thiagarajar College (Autonomous): Madurai – 625 009**

**Department of Botany**

(For those joined B. Sc., Botany on or after June 2020)

**Programme Code : UBO**

Course Code	Course Title	Category	L	T	P	Credit
UBO20CL21	Pteridophytes, Gymnosperms, Palaeobotany and Cell Biology Lab	Core Lab-2		-	4	2

Year	Semester	Int. Marks	Ext.Marks	Total
First	Second	40	60	100

**Preamble**

To make the students to identify first seed plants and basic structural features of cells

**Course Outcomes**

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

#	Course Outcome	Knowledge Level
CO1	Identify Pteridophytes and Gymnosperms based on their morphology and anatomy	K1
CO2	Discriminate the various kinds of fossil forms	K2
CO3	Perform squash technique to show the stages of mitotic and meiotic cell divisions	K1
CO4	Depict various cytoplasmic organelles	K3

**K1 – Knowledge**

**K2 – Understand**

**K3 – Apply**

**Mapping of COs with POs**

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

**Strong(S), Medium(M), Low(L)**

**Mapping of Course Outcomes with Programme Specific Outcomes**

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

**S-Strong M-Medium L-Low**

## **Pteridophytes, Gymnosperms and Palaeobotany**

Study of morphology, anatomy and reproductive structures of the following types

1. *Lycopodium*
2. *Equisetum*
3. *Pteridium*
4. *Marsilea*
5. *Pinus*

Study of internal organization of the following using permanent slides

6. *Psilotum*
7. *Cycas Leaf C.S*
8. *Gnetum*

Study of Fossil types

9. *Rhynia stem*
10. *Lepidodendron*

## **Cell biology Experiments**

1. Squash preparation of Onion root tip to show the stages of mitosis
2. Squash preparation of Tradescantia anthers to show the stages of meiosis
3. Smear preparation of microbial culture
4. Study of cell inclusions – Starch grain from banana, rice and potato
5. Study of cell inclusions - Cystolith (Ficus leaf), Raphides (Pothos leaf)
6. Identification of different cell organelles
7. Identification of special types of chromosomes
8. Demonstration of karyotyping

**Thiagarajar College (Autonomous): Madurai – 625 009**  
**Department of Botany**  
 (For those joined Botany on or after June 2020)  
**Programme Code : UBO**

Course Code	Course Title	Category	L	T	P	Credit
U20VE21	Value Education	AECC	2	-	-	1

Year	Semester	Int. Marks	Ext.Marks	Total
First	Second	15	35	50

### Preamble

Students acquire knowledge on the basic concepts, components and importance of environment.

### Course Outcomes

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

	Course outcomes	Knowledge Level
CO1	Define the structure and functions of ecosystem	K1
CO2	Explain the benefits of biodiversity conservation	K2
CO3	Summarise the sources, effects and control measures of various types of Pollutants	K1
CO4	Perceive the environment legislations in India for sustainable development.	K3

**K1: Knowledge K2: Understand K3: Apply**

### Mapping of Course Outcomes with Programme Specific Outcomes

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

### Mapping of Course Outcome with Programme Outcomes

	PSO1	PSO2	PSO3	PSO4	PSO5	PO6
CO1	L	-	M	-	-	-
CO2	-	L	M	L	-	L
CO3	M-	M	S	-	-	-
CO4		-	M	L	-	M

### Blooms taxonomy: Assessment Pattern

	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: Value Education

### Unit I

15hours

**Self Development** – Introduction - Definition and Types of Values – Self Assessment – Values needed for self development - Values needed for family life –Principles of happy living

**Character development**- Good character – Good relationships - Legendary people of highest character – The quest for character –Developing character -The key to good character.

### Unit II

15hours

**Positive Thinking and Self Esteem** - Types of thoughts - Areas of thinking - Developing thought pattern - External influences on Thoughts - Methods to keep outlook positive – Meaning of Self Esteem – Self empowerment.

**Stress free living** – Illusions and causes - Symptoms and stages of stress – Self confidence– Role models and leadership qualities – Critical thinking - Communication skills – Happy and successful life.

## Reference

Study material / Course material

Values for Excellence in Life Compiled by then Curriculum Development Cell Thiagarajar College, Madurai, in collaboration with the Education wing, Brahma Kumaris, Madurai.



# **M.Sc. Botany**

**Programme Code : PBO**



**THIAGARAJAR COLLEGE, MADURAI – 9.**  
**(Re-Accredited with ‘A’ Grade by NAAC)**  
**Curriculum Structure for PG**

<b>Semester</b>	<b>Category</b>	<b>No. of Courses</b>	<b>Credit Distribution</b>
<b>I</b>	<b>Core</b>	<b>---</b>	<b>18</b>
	<b>Elective</b>	<b>1</b>	<b>5</b>
<b>II</b>	<b>Core</b>	<b>---</b>	<b>18</b>
	<b>Elective</b>	<b>1</b>	<b>5</b>
<b>III</b>	<b>Core</b>	<b>---</b>	<b>18</b>
	<b>Elective</b>	<b>1</b>	<b>5</b>
<b>IV</b>	<b>Core</b>	<b>---</b>	<b>18</b>
	<b>Project</b>	<b>1</b>	<b>3</b>
<b>Total Credits</b>			<b>90</b>

**For Choice Based Credit System (CBCS)**

- **Choices should be offered for Elective Courses**
- **Total Credits for Core Courses 72**
- **Total Credits for Elective Courses 18 (3 Electives + 1 Project)**



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

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### **Knowledge**

Acquire an overview of concepts, fundamentals and advancements of science across a range of fields, with in-depth knowledge in at least one area of study. Develop focused field knowledge and amalgamate knowledge across different disciplines.

### **Complementary skills**

Students will be able to engage in critical investigation through principle approaches or methods and through effective information search and evaluation strategies. Employ highly developed conceptual, analytical, quantitative and technical skills and are adept with a range of technologies

### **Applied learning**

Students will be able to apply disciplinary or interdisciplinary learning across multiple contexts, integrating knowledge and practice. Recognize the need for information; effectively search for, evaluate, manage and apply that information in support of scientific investigation or scholarly debate

### **Communication**

Communicate effectively on scientific achievements, basic concepts and recent developments with experts and with society at large. Able to comprehend and write reports, documents, make effective presentation by oral and/or written form.

### **Problem solving**

Investigate, design and apply appropriate methods to solve problems in science, mathematics, technology and/or engineering.

### **Environment and sustainability**

Understand the impact of the solutions in ethical, societal and environmental contexts and demonstrate the knowledge of and need for sustainable development.

### **Teamwork, collaborative and management skills**

Recognize the opportunities and contribute positively in collaborative scientific research. Engage in intellectual exchange of ideas with researchers of other disciplines to address important research issues



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

**Programme Educational Objectives (PEO)**  
**M.Sc., Botany Programme**

The objectives of this Programme are to equip/prepare the Post Graduates of Botany:

<b>PEO1</b>	To develop competent knowledge in the subject of Plant Sciences, required for in-depth learning and research.
<b>PEO2</b>	To develop diversified basic professional skills through various laboratory technical training, communication and presentation skills.
<b>PEO3</b>	To facilitate the post graduates, with an ability to identify, formulate and solve problems, related to Plants, to contribute to community in both the professional and private realm
<b>PEO4</b>	To integrate allied topics from the components of the course such as levels of plant organization, cell biology, ecology, evolution, biochemistry, embryology, basic biotechnology, physiology, molecular biology, and taxonomy for successful career.
<b>PEO5</b>	To be proficient in assessing the scope of applying the gained knowledge in plant sciences, to address scientifically to the benefit of science and community

**Programme specific outcomes(PSOs)**

On successful completion of M.Sc., Botany, the students will be able to

<b>PSO1</b>	Carry out a thorough analysis on various plant life forms, using specific identification key characteristic features and also at micro level
<b>PSO2</b>	Comprehend the core concepts of Botany at organizational (both external morphology, internal morphology), cell and molecular levels, through which the developmental and physiological functioning of plants
<b>PSO3</b>	Demonstrate the principles of inheritance, basis for plant breeding, through macro propagation and using plant tissue culture and the latest concepts of molecular biology and biotechnology
<b>PSO4</b>	Exhibit proficiency in the areas of biostatistics and computer applications in modern topics of Life Sciences
<b>PSO5</b>	Reveal proficient laboratory skills and in contemporary and advance technique

**Thiagarajar College, Madurai – 9**  
**An Autonomous Institution Affiliated to Madurai Kamaraj University**  
**Re-Accredited with ‘A’ Grade by NAAC**  
**M.Sc., Botany Course Structure (w.e.f. 2020 batch onwards)**  
**Programme code:PBO**

**SEMESTER –I**

Course	Code No.	Subject	Contact Hrs/ Week	Credits	Total No of hours allotted	Max. Marks		Total
						CA	SE	
Core - 1	PBO20C11	Plant Diversity	5	4	75	25	75	100
Core - 2	PBO20C12	Plant Biochemistry and Biotechniques	5	4	75	25	75	100
Core - 3	PBO20C13	Developmental Botany	4	4	60	25	75	100
Elective 1	PBO20CE11	Entrepreneurial Botany	5	5	75	25	75	100
Core Lab- 1	PBO20CL11	Plant Diversity Lab	4	2	60	40	60	100
Core Lab- 2	PBO20CL12	Plant Biochemistry and Biotechniques Lab	4	2	60	40	60	100
Core Lab 3	PBO20CL13	Developmental Botany lab	3	2	45	40	60	100
		<b>Total</b>	<b>30</b>	<b>23</b>	<b>450</b>	<b>220</b>	<b>480</b>	<b>700</b>

**SEMESTER –II**

Course	Code No.	Subject	Contact Hrs/ Week	Credits	Total No. of hours allotted	Max. Marks		Total
						CA	SE	
Core - 4	PBO20C21	Plant Cell and Molecular Biology	5	4	75	25	75	100
Core - 5	PBO20C22	Microbiology and Plant Pathology	5	4	75	25	75	100
Core - 6	PBO20C23	Computer Applications in Biology and Biostatistics	4	4	60	25	75	100
Elective 2	PBO20CE21	Research Methodology	5	5	75	25	75	100
Core Lab- 4	PBO20CL21	Plant Cell and molecular Biology Lab	4	2	60	40	60	100
Core Lab- 5	PBO20CL22	Microbiology and Plant Pathology Lab	4	2	60	40	60	100
Core Lab 6	PBO20CL23	Computer Applications in Biology and Biostatistics Lab	3	2	45	40	60	100
		<b>Total</b>	<b>30</b>	<b>23</b>	<b>450</b>	<b>220</b>	<b>480</b>	<b>700</b>



### SEMESTER –III

Course	Code No.	Subject	Contact Hrs/ Week	Credits	Total No. of hours allotted	Max. Marks		Total
						CA	SE	
Core - 7	PBO20C31	Angiosperm Taxonomy	6	5	90	25	75	100
Core -8	PBO20C32	Plant Physiology	6	5	90	25	75	100
Core - 9	PBO20C33	Biophysics and Bioenergetics	4	4	60	25	75	100
Elective - 3 IDC	PZO20ID31	Inter Disciplinary Course – Applied Zoology	6	5	90	25	75	100
Core Lab 7	PBO20CL31	Angiosperm Taxonomy Lab	4	2	60	40	60	100
Core Lab 8	PBO20CL32	Plant Physiology Lab	4	2	60	40	60	100
			30	23	450	180	420	600

### SEMESTER –IV

Course	Code No.	Subject	Contact Hrs/ Week	Credits	Total No. of hours allotted	Max. Marks		Total
						CA	SE	
Core – 10	PBO20C41	Plant Biotechnology	6	5	90	25	75	100
Core -11	PBO20C42	Plant Ecology and Environmental Management system	6	5	90	25	75	100
Core - 12	PBOC2043	IPR and Biosafety	4	4	60	25	75	100
Core Lab 9	PBO20CL41	Plant Biotechnology Lab	4	2	60	40	60	100
Core Lab 10	PBO20CL42	Plant Ecology, Environment lab	4	2	60	40	60	100
Project	PBO20PJ41	Project and Viva voce	6	3	90	40	40+20	100
			30	21	450	195	405	600
<b>Total No of Credits 23+23+23+21= 90</b>				<b>Total Marks = 2600</b>				

Number Core Theory courses:	12
Number of Core Practical Course:	10
Number of Core Elective Courses:	3 (Including Project)
Number of Interdisciplinary elective Course:	1

Credit Distribution:

I year:	46	Core theory courses:	52
II year:	44	Core lab courses:	20
<b>Total:</b>	<b>90</b>	Elective courses:	15
		Project:	3
		<b>Total:</b>	<b>90</b>

**Interdisciplinary Course: Applied Zoology (PZO20ID31) offered by Dept. of Zoology**

**Theory: Internal:** 25 Marks [Assignment 10 marks; Seminar 10 marks; Test 30 marks(duration 2hrs). Total marks of 50 reduced to 25].

**External:** 75 marks (duration 3 hrs).

**Practical: Internal:** 40 marks (Record 15 marks; Test / Continuous Assessment: 25 marks).

**External:** 60 marks (duration 3 hrs).

**Project:** Internal 40 + External 40 + External Viva (closed) 20 = 100.

**Interdisciplinary Course: Plant Tissue Culture (PBO20ID31) offered by the Department of Botany to M. Sc., Zoology students in Semester III**

**Thiagarajar College (Autonomous): Madurai – 625 009**

**Department of Botany**

(For those joined M. Sc., Botany on or after June 2020)

**Programme Code-PBO**

Course Code	Course Title	Category	L	T	P	Credit
PBO20C11	Plant Diversity	Core - 1	4	1	-	4

Year	Semester	Int. Marks	Ext.Marks	Total
First	First	25	75	100

### Preamble

To familiarize plant diversity, complexity and its significance

### Course outcomes

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

#	Course Outcome	Knowledge Level
CO1	Comprehend various groups of plants	K1
CO2	Elucidate the phylogenetic sequence of plant groups	K2
CO3	Reveal the economic significance of various plant forms	K2
CO4	Scrutinize their ecological adaptations, internal organization and reproductive specialization	K3
CO5	Analyze the fossil forms and the reasons for fossilization, Significance of fossil study	K5

K1 - Knowledge K2 - Understand K3 - Apply K4 - Analyze K5- Evaluate

### Mapping of COs with Pos

	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	S	S	S	S	M	S	S
CO2	S	S	S	S	M	S	S
CO3	S	S	S	S	M	S	S
CO4	S	S	S	S	M	S	S
CO5	S	S	S	S	M	S	S

Strong(S), Medium(M), Low(L)

### Mapping of COs with PSOs

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

S:Strong M:Medium L: Low

## Blooms taxonomy

	CA		End of Semester Marks
	I Internal Marks	II Internal Marks	
Knowledge -K1	15% (9)	15% (9)	20% (30)
Understand -K2	15% (9)	15% (9)	20% (30)
Apply-K3	30% (18)	30% ( 18)	20% (30)
Analyze-K4	20% ( 12)	20% ( 12)	20% (30)
Evaluate-K5	20% ( 12)	20% ( 12)	20% (30)
TOTAL	<b>60</b>	<b>60</b>	<b>150</b>

## Course Title : Plant Diversity

**Unit I:** Classification of Algae by Chapman and Chapman (1973)–General Characters of the following divisions: Cyanophyta, Chlorophyta, Phaeophyta and Rhodophyta – Various habitats of algae - Freshwater, Marine and Soil - Range of thallus construction in Algae - Life cycle patterns in Algae – Economic importance of Algae.

**Unit II:** Classification of Fungi by Alexopoulos and Mims (1979) - General characters of the following classes: Myxomycetes, Phycomycetes, Oomycetes, Zygomycetes, Ascomycetes, Basidiomycetes and Deuteromycetes. Economic importance of fungi. Lichens: nature and composition –classification – vegetative and sexual reproduction. Economic importance of Lichens.

**Unit III:** Classification of Bryophytes by Watson (1968). Characteristic features of Hepaticopsida, Anthocertopsida and Bryopsida. Range of gametophytes and sporophytes in Bryophytes.Economic importance of Bryophytes.

**Unit IV:** Classification of Pteridophytes by Smith (1955). General features of Psilopsida,Lycopsida, Sphenopsida and Pteropsida. Stelar evolution – Apospory and Apogamy - Heterospory and Seed Habit. Economic importance of Pteridophytes.

**Unit V:** Classification of Gymnosperms by Sporne (1962). Salient features of Pteridospermales, Cordaitales, Pentaxylales, Ginkgoales, Coniferales, Gnetales and Ephedrales. Organization of male and female cones in Coniferales, Gnetales and Ephedrales. Economic importance of Gymnosperms.

**Text Books:**

1. Kumar H.D. 1988. Introductory Phycology. East West Press, New Delhi.
2. Vashista B.R and Sinha, A.K. 2005. Botany for degree students – Algae, S. Chand & Co., New Delhi.
3. Vashista B.R & A.K Sinha 2005. Botany for degree students – Bryophyta, S. Chand & Co., New Delhi.
4. ChandrakantPathak 2003. First Edition. Bryophyta, Dominant Publishers and Distributors, New Delhi.
5. Rashid, A. 1998. An introduction to bryophytes. Vikas Publishing House Pvt. Ltd., New Delhi.
6. Ahamadjian, V. 1973. The Lichens. Academic Press. New Delhi.
7. Vashista B.R., Sinha A.K., Kumar A. 2008. Botany for degree students - Pteridophyta, S. Chand & Co., New Delhi.
8. Sharma, O.P. 1990. Textbook of Pteridophyta. MacMillan India Ltd., New Delhi.
9. Vashishta. P.C., A.K. Sinha and Anil Kumar. 2007. Botany for Degree students - Gymnosperms. S. Chand & Co., New Delhi.
10. Meyen, S.V. 1987. Fundamentals of Palaeobotany. Chapman and Hall, New York.

**Reference Books:**

1. Fritsch, F.E. 1935. Structure and reproduction of the algae. Vol. I & II; Cambridge University Press, New York.
2. Sundaralingam, V. 1991. Marine algae. Bishen Singh and Mahendra Pal Singh Publishers, Dehradun.

**Web Sources:**

- <http://ndl.iitkgp.ac.in/document/MGJrWIJ5Y0s4MngzNVRtL2V2SGpmNDhoVXA3aCtmazhnWitwQ1h2cCtvQT0>
- <http://ndl.iitkgp.ac.in/document/VVZXUDISQ2ZNSIVaWUVXT3RFdUhvQTZQT0JDMHM0bmQzdHVNc0pnMWVtUT0>
- <https://www.encyclopedia.com/plants-and-animals/botany/botany-general/pteridophytes>
- <https://plantfacts.osu.edu/resources/hcs300/gymno.htm>

Course Designer  
Dr.K.Saraswathi

**Thiagarajar College (Autonomous): Madurai – 625 009**

**Department of Botany**

(For those joined M. Sc., Botany on or after June 2020)

**Programme Code-PBO**

Course Code	Course Title	Category	L	T	P	Credit
PBO20CL11	Plant Diversity Lab	Core Lab-1	-	-	4	2

Year	Semester	Int. Marks	Ext.Marks	Total
First	First	40	60	100

**Preamble**

To familiarize plant diversity, complexity and its significance

**Course Outcomes**

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

#	CourseOutcome	Knowledge Level
CO1	Classify various groups of plants	K1
CO2	Dissect and draw internal structures of different plant forms	K4
CO3	Isolate fungi from different sources	K2
CO4	explain the ecological adaptations, internal organization and reproductive specialization of different plant groups	K3
CO5	Analyze the fossil forms and the reasons for fossilization	K5

K1 - Knowledge K2 - Understand K3 - Apply K4 - Analyze K5- Evaluate

**Mapping of COs with POs**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	S	M	S	M	M	S	M
CO2	S	S	S	M	M	M	S
CO3	S	S	S	M	S	M	S
CO4	S	M	S	M	S	S	S
CO5	S	M	S	M	M	S	M

Strong(S), Medium(M), Low(L)

**Mapping of COs with PSOs**

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

S:Strong M:Medium L: Low

1. Limnological study of the aquatic and terrestrial microalgae of temple tank, pond and lake.
2. Study of the structure of *Oscillatoria*, *Spirulina*, *Nostoc*, *Anabaena*, *Microcystis* and *Scytonema*.
3. Study of the structure of *Tolypothrix*, *Westiellopsis*, *Cylindrospermum*, *Chlorella* and *Diatoms*.
4. Study of the external and internal structure of macroscopic seaweeds – *Ulva*, *Caulerpa*, *Padina*, *Sargassum*, *Gracilaria*.
5. Isolation and identification of fungi from bread, pickle, soil, seed and dung.
6. Identification and micropreparation of *Rhizopus*, *Mucor*, *Pilobolus*, *Aspergillus*, *Penicillium* and *Trichoderma*.
7. Identification and micropreparation of *Fusarium*, *Curvularia*, *Alternaria*, *Agaricus*, *Polyporus* and *Peziza*.
8. Study of the structure of Crustose, Foliose and Fruticose lichen thallus.
9. Study of the external and internal structure of *Marchantia*, *Porella* and *Pellia*.
10. Study of sporophyte and gametophyte structures of *Funaria*.
11. Study of the Pteridophytes stele types using permanent slides.
12. Study of the external and internal structure of *Equisetum* stem.
13. Study of the structure of *Equisetum* cone.
14. Study of the external and internal structure of *Ceratopteris* sorus.
15. Study of the external and internal structure of *Marsilea* rhizome, petiole and sporocarp
16. Study of internal structure of *Araucaria* stem.
17. Study of internal structure of *Cupressus* stem.
18. Study of internal structure of *Podocarpus* stem.
19. Study of fossil slides of *Lyginopteris*, *Lagenostoma* and *Medullosa*.

**Course Designer**  
**Dr. K. Saraswathi**

**Thiagarajar College (Autonomous): Madurai – 625 009**

**Department of Botany**

(For those joined M. Sc., Botany on or after June 2020)

**Programme Code-PBO**

Course Code	Course Title	Category	L	T	P	Credit
PBO20C12	Plant Biochemistry and Biotechniques	Core- 2	4	1	-	4

Year	Semester	Int. Marks	Ext.Marks	Total
First	First	25	75	100

**Preamble**

To acquire the knowledge of plant cell biomolecules and techniques

**Course Outcomes**

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

#	Course Outcome	Knowledge Level
CO1	describe the structure & function of the Biomolecules.	K1
CO2	explain the enzyme kinetics	K4
CO3	analyze different secondary metabolites	K2
CO4	depict the basic principles of Biotechniques.	K3
CO5	Demonstrate the application of Biotechniques.	K5

K1 - Knowledge K2 - Understand K3 - Apply K4 - Analyze K5- Evaluate

**Mapping of COs with POs**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	S	S	S	S	M	S	S
CO2	S	S	S	S	M	S	S
CO3	S	S	S	S	M	S	S
CO4	S	S	S	S	M	S	S
CO5	S	S	S	S	M	S	S

**Mapping of COs with PSOs**

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



<b>Blooms Taxonomy</b>			
	<b>CA</b>		<b>End of Semester Marks</b>
	<b>I Internal Marks</b>	<b>II Internal Marks</b>	
Knowledge -K1	15% (9)	15% (9)	20% (30)
Understand -K2	15% (9)	15% (9)	20% (30)
Apply-K3	30% (18)	30% (18)	20% (30)
Analyze-K4	20% (12)	20% (12)	20% (30)
Evaluate-K5	20% (12)	20% (12)	20% (30)
<b>TOTAL</b>	<b>60</b>	<b>60</b>	<b>150</b>

**Course Title : Plant Biochemistry and Biotechniques**

**Unit I:** Amino acids: Protein and non-protein amino acids– Reductive amination and Transamination – Glutamate pathway: Structure and biosynthesis of Glutamic acid, Serine, Cysteine – Shikimic acid pathway: Structure and biosynthesis of Phenylalanine, Tyrosine and Tryptophan. Protein: Biosynthesis of protein - formation of peptide bonds and polypeptide chain – Molecular configuration and conformation of proteins: Primary, Secondary, Tertiary and Quaternary structures – Types of proteins –Simple, Complex and Derived proteins.

**Unit II:** Enzymes: Classification - Mechanism of enzyme action – Kinetics: Michaelis-Menten constant, Lineweaver-Burk plot -Factors affecting enzyme action -enzyme inhibition – enzyme regulation – allosteric enzymes – isoenzymes – coenzymes – ribozymes. Vitamins: General characters, Classification - Vitamins with coenzyme function: NAD, NADP, FMN, FAD. Pigments: Structure and function of photosynthetic and non-photosynthetic pigments - Chlorophyll, Carotenoid, Phycobilins, Anthocyanin and Betacyanins. Secondary metabolites: Alkaloids - Structure and function of quinine, atropine, colchicine. Structure and function of Triterpenoids.

**Unit III:** Plant Lipids: Bloor’s Classification, Structure of Triglycerids – Fatty acids (Saturated and unsaturated), Structure and function Phospholipids, Ergosterol and Cholesterol. Structure and function of Glyoxysomes, Glyoxalate cycle -  $\beta$  -Oxidation of fatty acids. Carbohydrates: Classification - Mono, Oligo and Polysaccharides - Glycosidic bond. Monosaccharides – Triose, Tetrose, Pentose and hexoses- Aldo and ketoses. Isomerism – Epimer, Enantiomer and Anomers. Structure and functions of Sucrose, Maltose - Structure and functions of Starch and Cellulose.

**Unit IV:** Principles, technique and applications of the following biotechniques:  
 Centrifugation - Ultracentrifuges: preparative and analytical- types of rotors pH metry  
 Spectrophotometry: UV-Visible – IR  
 Spectrophotometry Chromatography: Gas-Liquid Chromatography (GLC) and High Performance (pressure) Liquid Chromatography (HPLC).

**Unit V:** Electrophoresis: Agarose, PAGE and immunotechniques (ELISA) Blotting: Southern blot and Western blot  
 Flow Cytometry

Radiolabelling techniques: GM counter, Scintillation counter and Autoradiography.

**Text books:**

1. Nelson, D.L. and M.M. Cox. 2000. Lehninger – Principles of Biochemistry. Worth Publishers, New York.
2. Weil, J. H. 1997. General Biochemistry. New Age International Ltd., New Delhi.
3. Voet, D and J.H. Voet. 1995. Biochemistry. John Wiley and Sons, New York.
- 4 Campbell, M. K., and O. F Shawn. 2007. Biochemistry. Sixth Edition, Thompson. Brooks/Cole, USA
- 5 Gurumani, M. 2006. Research Methodology, MJP Publishers, Chennai.

### **Reference Books:**

- Berg, J.M., J.L. Tymoczko, and L., Stryer, 2001. Biochemistry. Freeman and Company, New York.
- Lea, P.J. and R.C. Leegood, 2001. Plant Biochemistry and Molecular Biology, John Wiley and Sons, New York.
- Garrett, R. G. and C. M. Grisham, 2010. Biochemistry. Mary Finch Publishers, Boston.
- Wilson, K. and Walker, J. 2000. Practical Biochemistry- Principles and Techniques. Cambridge University Press, Cambridge, U.K..

Course Designer

Dr.K.Jegatheesa

**Thiagarajar College (Autonomous): Madurai – 625 009**  
**Department of Botany**  
 (For those joined M. Sc., Botany on or after June 2020)  
**Programme Code-PBO**

Course Code	Course Title	Category	L	T	P	Credit
PBO20CL12	Plant Biochemistry and Biotechniques Lab	Core Lab- 2		-	4	2

Year	Semester	Int. Marks	Ext.Marks	Total
First	Second	40	60	100

### Preamble

To acquire the knowledge of plant cell biomolecules and techniques

### Course Outcomes

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

#	Course Outcome	Knowledge Level
CO1	describe the principle of pH meter and pKa	K1
CO2	Find out the isoelectric pH of aminoacids and proteins	K4
CO3	analyze different primary metabolites	K2
CO4	depict the basic principles of Biotechniques.	K3
CO5	Demonstrate the application of Biotechniques.	K5

K1 - Knowledge K2 - Understand K3 - Apply K4 - Analyze K5- Evaluate

### Mapping of COs with POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	S	S	S	S	M	S	S
CO2	S	S	S	S	M	S	S
CO3	S	S	S	S	M	S	S
CO4	S	S	S	S	M	S	S
CO5	S	S	S	S	M	S	S

### Mapping of COs with PSOs

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

1. Preparation of titration curve and pKa value determination.
2. Determination of isoionic pH of amino acid.
3. Determination of isoelectric pH of protein.
4. Estimation of protein content in legume.
5. Estimation of free amino acids content in plant source.
6. Estimation of soluble sugars content in plant source.
7. Estimation of anthocyanins.
8. Estimation of cholesterol content
9. Determination of saponification value of fat
10. Paper chromatographic identification of amino acids.
11. Effect of temperature on Nitrate Reductase activity.
12. Effect of substrate concentration on Nitrate Reductase activity.
13. Effect of pH on Nitrate Reductase activity
14. Effect of inhibitor concentration on Nitrate Reductase activity
15. Separation of proteins by PAGE

**Thiagarajar College (Autonomous):: Madurai – 625 009**  
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**Programme Code-PBO**

Course Code	Course Title	Category	L	T	P	Credit
			4	-	-	
PBO20C13	Developmental Botany	Core-3				

L - Lecture                      T - Tutorial                      P - Practical

Year	Semester	Int. Marks	Ext.Marks	Total
I	I	25	75	100

### Preamble

To acquire in-depth knowledge of embryological development of angiosperm plant and their components.

### Prerequisite

The student must have completed the related course during under graduate programme.

### Course Outcomes

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

#	Course Outcome	Knowledge Level
CO1	Comprehend the contributions by the national and international embryologists to the subject and to evaluate the application of the subject knowledge to other branches and industries	K1
CO2	Examine the development of microspore and megaspore	K2
CO3	Depict the fertilization and post-fertilization processes, incompatibility and demonstrate the methods of overcoming self incompatibility	K3
CO4	Demonstrate Embryogenesis, development of fruit, polyembryony, apomixis	K4
CO5	Comprehend the tissue differentiation, plant galls, crown gall tumours and biological significance	K5

K1 - Knowledge      K2 - Understand      K3 – Apply      K4 - Analyze      K5 - Evaluate

### Mapping of COs with POs

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

**Strong(S), Medium(M), Low(L)**

### Mapping of COs with PSOs

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

## Blooms taxonomy

	CA		End of Semester
	First	Second	
Knowledge -K1	15% (9)	15% (9)	20% (30)
Understand -K2	15% (9)	15% (9)	20% (30)
Apply-K3	30%(18)	30% (18)	20% (30)
Analyze-K4	20% (12)	20% (12)	20% (30)
Evaluate-K5	20% (12)	20% (12)	20% (30)
<i>Total</i>	60	60	150

## Course Title : Plant Biochemistry and Biotechniques

**Unit - I:** Historical account – Contributions of Indian Plant Embryologists – Maheswari, P, Johri BM, Swamy, BGL., International Plant Embryologists – Amici, G.B., Wihalm Hofmeister, Edward Strasburger, Sergius Nawaschin, Wunderlich; Scope on plant embryology: to other branches of botany – taxonomy, cell biology, plant tissue culture, molecular biology and industries – plant breeding, secondary plant metabolites

**Unit – II:** Microsporogenesis - Microsporangium – Morphology and development of Male gametophyte; wall layers, tapetum, MMC and microspores – Megasporogenesis - Megasporangium – structure and organization of embryo sac; positional variation and development

**Unit – III:** Fertilization and post – fertilization – Pollination - Pollen germination, pollen tube growth and cellular, biochemical changes; Self-incompatibility, Genetic basis of self-incompatibility, Barriers to fertilization, Significance of Incompatibility, Methods to overcome incompatibility Syngamy and types; Double fertilization- Definition, importance; Triple fusion – Endosperm cellular, nuclear and helobial types, endosperm haustoria types and functions

**Unit IV-** Embryogenesis - Embryo Development stages - cell lineages during late embryo development – Dicot embryo and monocot embryo development - Agamospermy and Polyembryony and Apomixis – types -. Fruit – and Seed development – Seed coats, Aril structure, parthenocarpy – types and significance

**Unit V:** Morphogenesis – Definition, scope and importance; Concepts - differentiation, dedifferentiation, re-differentiation, polarity, symmetry - Morphogenetic factors - Physical, mechanical, chemical and genetic factors – Plant Galls – types, causal organisms – phytocecidion, zoocecidion, Development process and crown gall plant tumours – Biological significance

## Text Books:

1. Mani, M.S. 1964. Ecology of Plant Galls, Springer Sciences Business Media, Dordrecht, UK.
2. Swamy B.G.L and Krishnamurthy K.V 1990 From flower to fruits ,Tata – McGraw Hill publishing CoLtd , New Delhi
3. Maheswari.P 1991. An Introduction to Embryology of Angiosperms. Tata- McGraw hill Publishing Co .Ltd. New Delhi
4. Raghavan,V. 1997. Molecular embryology of flowering plants. Cambridge University Press. UK.
5. Pullaiah, T., Lakshminarayanan, K. and Hanumantha Rao, B. 2001. Text book of embryology of angiosperms, Regency Publications, New Delhi.

6. Lersten, N.R. 2004. Flowering Plant Embryology. Blackwell Publishing, Australia.
7. Bhojwani, S.S. Bhatnagar, S.P. and Dantu, P.K. 2015. The Embryology of Angiosperms (6th revised and enlarged edition). Vikas Publishing House, New Delhi.

### References:

1. Burgess, J. 1985 An Introduction to Plant Cell Development. Cambridge University Press, Cambridge, London
2. Leins, P., Tucker, S.C. and Endress, P.K. (1988) Aspects of Floral Development, J. Cramer, Germany, 1988.
3. Fosker, D.E. 1994. Plant Growth and Development. A Molecular Approach. Academic Press, San Diego, USA.
4. Howell, S.H. 1998. Molecular Genetics of Plant Development. Cambridge University press, Cambridge, London
5. Bhojwani, S.S. and Soh, W.Y. 2001. Current Trends in the embryology of angiosperms. Kluwer Academic Publishers. The Netherlands.

### Web Resources:

1. History of Plant Embryology – <https://www.slideshare.net/HimanshiChauhan1/history-of-embryology-in-plants>
2. Fertilization in plants (animated) - <https://www.youtube.com/watch?v=dgFY7WUTASQ>
3. Embryo, Fruit and Development (animated) - <https://www.youtube.com/watch?v=a9n2aUI5Xuw>
4. Apomixis and polyembryony (animated) - <https://www.youtube.com/watch?v=XoPMY9rPhMo>
5. Development of Dicot Embryo - <https://www.youtube.com/watch?v=DPcSTA3EUE4>

### Course Designee::

Dr. D. Kannan

**Thiagarajar College (Autonomous):: Madurai – 625 009**  
**Department of Botany-**  
 (For those joined 2020-2021 on or after June 2020)  
**Programme Code-PBO**

Course Code	Course Title	Category	L	T	P	Credit
PBO20CL13	Developmental Botany Lab	Core Lab-3	--	--	3	2

L - Lecture                      T - Tutorial                      P - Practicals

Year	Semester	Int. Marks	Ext. Marks	Total
I	I	40	60	100

**Preamble**

**To practice the practical approach by experimenting and analyzing the features of developmental aspects of plants and their various components**

**Prerequisite**

The student must have completed the related course during under graduate programme

**Course Outcomes**

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

#	Course Outcome	Knowledge Level
CO1	Identifying the images and to relate the contributions by the national and international embryologists to the subject and to determine the relationship between plant embryology with different branches of Botany	K1
CO2	Develop Skill and apply knowledge through pictorial diagrams on the structural details of microspore and megaspore	K3
CO3	Evaluate the fertilization and post-fertilization processes	K5
CO4	Analyze the embryo stages and to demonstrate ht tissue differentiation, analytical ability of plant galls, crown gall tumours and analysis of biological significance	K4

K1 - Knowledge                      K2 - Understand                      K3 - Apply                      K4 - Analyze                      K5 - Evaluate

**Mapping of COs with POs**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	S	S	S	M	L	M	S
CO2	S	S	S	M	M	M	S
CO3	S	S	M	S	L	L	S
CO4	S	S	L	M	M	S	S

**Strong(S), Medium(M), Low(L)**

**Mapping of COs with PSOs**

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



1. Anatomical structure of Anther and Pistil
2. Embryo Dissection using the ovary of *Tridax procumbens* – identification of embryonic stages (globular, heart shaped, torpedo shaped)
3. Analysis of pollen tube growth using pollen grains of Cassia in different sugar concentration
4. Endosperm haustoria separation from the endosperm tissue of *Cucumis sativus*
5. Demonstration of Embryogenesis
6. Demonstration of hairy root culture using *Agrobacterium tumefaciens*
7. Leaf galls dissection – *Syzygium jambloanum*
8. Crown gall dissection
9. Plant specimens, permanent slides observation, Models portraying the structural details on the syllabus components
10. Submission of Record for external valuation

**Thiagarajar College (Autonomous): Madurai – 625 009****Department of Botany**

(For those joined M. Sc., Botany on or after June 2020)

**Programme Code-PBO**

Course Code	Course Title	Category	L	T	P	Credit
PBO20CE11	Entrepreneurial Botany	Core Elective- 1	5	-	-	5

Year	Semester	Int. Marks	Ext.Marks	Total
First	First	25	75	100

**Preamble**

To Equip the Students with entrepreneurial skills related to Applied Botany

**Course Outcomes**

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

#	CourseOutcome	Knowledge Level
CO1	Develop Basic Knowledge on Business	K3
CO2	Demonstrate Mushroom Cultivation	K2
CO3	Explain the Mass Production of Biofertilizers and Organic Manure	K5
CO4	Discover the methods to propagate and maintain plants	K4
CO5	Exhibit skill to prepare flower bouquet, vases for sale and to apply the preservation techniques for management and utilization of harvested products	K3

K1 - Knowledge      K2 - Understand      K3 – Apply      K4- Analyze      K5- Evaluate

**Mapping of COs with POs**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	M	S	M	L	L	M	S
CO2	S	S	S	S	S	S	S
CO3	S	S	S	S	S	S	S
CO4	S	S	S	S	S	S	S
CO5	S	S	S	S	S	S	S

Strong(S), Medium (M), Low (L)

**Mapping of COs with PSOs**

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

Strong(S), Medium (M), Low (L)

**Blooms taxonomy**

	CA		End Semester Marks
	I Internal Marks	II Internal Marks	
Knowledge -K1	15% (9)	15% (9)	20% (30)
Understand -K2	15% (9)	15% (9)	20% (30)
Apply-K3	30% (18)	30% (18)	20% (30)
Analyze-K4	20% (12)	20% (12)	20% (30)
Evaluate-K5	20% (12)	20% (12)	20% (30)
<b>TOTAL</b>	<b>60</b>	<b>60</b>	<b>150</b>

**Course Title : Entrepreneurial Botany**

**Unit I:** Entrepreneur: Characteristics, Functions, Classification. Entrepreneurship- definition, factors stimulating and affecting entrepreneurship in India - Institutional support to entrepreneurs.- Institutional Support System – National Skill Developmental Agency, National Small Industries Corporation (NSIC), Khadi and Village Industries Commission (KVIC), National Bank for Agriculture and Rural Development (NABARD) -Innovation and promotional steps – Development and Marketing of New and value added products.

**Unit II:** Mushroom Cultivation: Introduction, Edible and Poisonous mushrooms, Nutritional Value of Mushrooms, Oyster mushroom and Paddy Straw Mushroom cultivation – Substrate Preparation, Spawn Preparation, Various Methods of Cultivation, Control of Contamination, Post –Harvest – Packaging – Storage – Long-term and short term, Mushroom powder - Economics of Mushroom Production – Export Marketing and Trading agencies in India

**Unit III:** Biofertilizers: Introduction, Types bifertilizers – Algae, Bacteria, Fungi. Seaweed Liquid Fertilizer, Mass production of *Azolla*, *Rhizobium*, Mycorrhiza, Phosphate Solubilizing Bacteria-*Pseudomonas* and seaweed fertilizers. Organic Manure: Preparation and advantages of Farmyard Manure, Vermicompost, Panchagavya, Dasagavya, Coir Compost. Economics of various Composting Methods; Major Trading Agencies in India

**Unit IV:** Horticulture Plant Propagation Techniques: Cutting, Layering, Budding, Grafting.; Seed collection and storage, seed vigour and seed dormancy tests; Nursery – Importance and Applications, Categories – Bare root, containers, Site Selection, soil mix, green house, shade net house, mist house conditions with their basic designs; water, soil nutrition and Pest and Disease Managements, Seedling and propagates packing and transportation - Specialized methods – Cut flowers, Terrace gardening, Terrarium preparation techniques-hydroponics-Bonsai

**Unit V:** Flower arrangement: Principles of Floral Designs, Basic types Horizontal, Vertical, Oval, Minimal, Crescent, Triangular, Hogarth’s Curve, Ikebana, Dry flower arrangement, Greeting Card Preparation. Food Products manufacturing: Jam, Jelly, Pickle Economics of Horticultural Products.

**Text Books:**

1. Gordon, E. and Natarajan, K. 2016. Entrepreneurship Development, Himalaya Publishing House, Mumbai
2. Nita Bahl. 1996, Hand Book On Mushrooms. Oxford and IBH Publishing Company Ltd., New Delhi.

3. Subba Rao. N.S. 1988. Biofertilizers in Agriculture, second Edition, Oxford & IBH Publishing Company Pvt. Ltd., New Delhi.
4. Palaniappan SP & Anandurai K. 1999. Organic Farming – Theory and Practice. Scientific Publications
5. Sadhu, M.K. 1996. Plant propagation. New age international publisher, New Delhi.
6. Ratha Krishnan, P., Rajwant K. Kalia, Tewari, J.C. and Roy, M.M. 2014. Plant Nursery Management: Principles and Practices. Central Arid Zone Research Institute, Jodhpur.

**Reference Books:**

1. Subba Rao, N.S 1982. Advances in Agricultural Microbiology, Oxford & IBH Publishing Company pvt. Ltd., New Delhi.
2. Venkatraman, G.S. 1972. Algal Biofertilizer and Rice Cultivation, Today and Tomorrow printers and Publishers, New Delhi.
3. Prasad and Kumar, U. 2005. Commercial Floriculture. Agrobios (India), Jodhpur.
4. Aneja, K.R. 1993. Experiments in Microbiology, Plant pathology, Tissue culture and mushroom cultivation, Wishwa Prakashan, New Age International (P) Ltd., New Delhi.

**Web Sources:**

1. The National Small Industries Corporation – [www.nsic.co.in](http://www.nsic.co.in)
2. <https://www.dgreetings.com/fragrance-flowers/type-of-flower-arrangement.html>
3. [https://nchfp.uga.edu/publications/usda/GUIDE07\\_HomeCan\\_rev0715.pdf](https://nchfp.uga.edu/publications/usda/GUIDE07_HomeCan_rev0715.pdf)
4. <https://www.architecturaldigest.com/story/3-pro-florists-arrangements-you-can-do-at-home>
5. <https://ptgmedia.pearsoncmg.com/images/9780133966817/samplepages/9780133966817.pdf>

**Course Designer:**

1. Dr. K. Saraswathi

**Thiagarajar College (Autonomous): Madurai – 625 009****Department of Botany**

(For those joined M. Sc., Botany on or after June 2020)

**Programme Code-PBO**

Course Code	Course Title	Category	L	T	P	Credit
PBO20C21	<b>Plant cell and Molecular Biology</b>	<b>Core- 4</b>	<b>4</b>	<b>1</b>	<b>-</b>	<b>4</b>

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

**Preamble**

To acquire the knowledge of plant cell and molecular biology

**Course Outcomes**

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

#	Course Outcome	Knowledge Level
CO1	Explain the principles of microscopic techniques	K1
CO2	Comprehend nucleus and chromosomes	K2
CO3	Depict the different plant genomes	K2
CO4	Illustrate the gene expression in prokaryotes	K3
CO5	Describe the gene expression system in Eukaryotes	K5

**Mapping of COs with POs**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	S	S	S	S	M	S	S
CO2	S	S	S	S	M	S	S
CO3	S	S	S	S	M	S	S
CO4	S	S	S	S	M	S	S
CO5	S	S	S	S	M	S	S

**Mapping of COs with PSOs**

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

**S:Strong M:Medium L: Low**

**Blooms Taxonomy**

	CA		End of Semester Marks
	I Internal Marks	II Internal Marks	
Knowledge -K1	15% (9)	15% (9)	20% (30)
Understand -K2	15% (9)	15% (9)	20% (30)
Apply-K3	30% (18)	30% (18)	20% (30)
Analyze-K4	20% (12)	20% (12)	20% (30)
Evaluate-K5	20% (12)	20% (12)	20% (30)
TOTAL	<b>60</b>	<b>60</b>	<b>150</b>

**Course Title: Plant cell and Molecular Biology**

**Unit I:** Microscopy – Light, Phase Contrast Microscopy, TEM, SEM. Cell: Ultra structure of plant cell. Cell wall: Primary structure – secondary structure. Plasma membrane: Fluid Mosaic model-properties. Cytosol: cytoskeleton organisation. Cell organelles: – mitochondria – plastids – endoplasmic reticulum – Golgi complex, peroxisomes, ribosome.

**Unit II:** Nucleus: structure and function. Chromosome: Euchromatin and heterochromatin - polytene, lampbrush chromosome. Cell cycle. Cell division: Mitosis, Meiosis - Chiasma – Synaptonemal complex. Nuclear DNA: Conformation-A, B, Z DNA- Nucleosome Concept. RNA conformation: t-RNA, micro RNA, chloroplast and mitochondrial DNA.

**Unit III:** DNA Replication in Prokaryotes-Rolling Circle. Replication of eukaryotic DNA – enzymes involved – amplification and rearrangement. Bacterial genetic recombination: conjugation, transformation, transduction. DNA damage – endogenous damage – oxidation – alkylation - methylation – exogenous damage - effects of UV radiation on DNA. DNA repair – base excision repair– mismatch repair – SOS response.

**Unit IV:** Regulation of gene expression in Prokaryotes – induction and repression – lac operon: negative control – gene architecture – promoter, regulator, structural genes and mechanism of action. positive control – CAP-cAMP method. trp repressible operon - attenuation and antitermination.

**Unit V:** Regulation of gene expression in Eukaryotes – mechanism of regulation – enhancers and silencers - activation of transcription by steroid hormones- methylation - post transcriptional modification: capping, polyadenylation, pre-mRNA splicing- regulation of mRNA stability - Introns and Exons. Post translational modifications.

**Text Books:**

1. Becker, W.M., L.J. Kleinsmith and J. Hardin, 2011. The world of the cell. Dorling Kindersley (India) Pvt. Ltd., NewDelhi.
2. Verma, P.S., 2006. Cell Biology Genetics Molecular Biology Evolution And Ecology. S.Chand and Co., New Delhi.
3. Singh, B. D., 2004. Genetics, Kalyani Publishers, NewDelhi.
4. Sheeler, P. and D.E. Binachi. 2004. Cell and Molecular Biology, John Wile & Sons, New York.

**Reference books:**

1. Geoffrey M. Cooper, Robert, E. Hansman. 2007. The cell – A Molecular Approach, Sinauer Associates. USA
2. Miglani, G.S. 2002. Advanced Genetics, Narosa Publishing House, NewDelhi.

Course designer : Dr.K.Jegatheesan

**Thiagarajar College (Autonomous): Madurai – 625 009**

**Department of Botany**

(For those joined M. Sc., Botany on or after June 2020)

**Programme Code-PBO**

Course Code	Course Title	Category	L	T	P	Credit
PBO20CL21	Plant cell and Molecular Biology Lab	Core Lab- 4	-	-	4	2

Year	Semester	Int. Marks	Ext.Marks	Total
First	Second	40	60	100

### Preamble

To acquire the practical knowledge of plant cell and molecular biology

### Course Outcomes

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

#	Course Outcome	Knowledge Level
CO1	Isolate genomic DNA from microbes and plants	K1
CO2	separate protein by electrophoresis	K5
CO3	Show the different stages of mitosis and meiosis	K2
CO4	Isolate antibiotic resistant colonies	K3,

K1 - Knowledge K2 - Understand K3 - Apply K4 - Analyze K5- Evaluate

### Mapping of COs with POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	S	S	S	S	M	S	S
CO2	S	S	S	S	M	S	S
CO3	S	S	S	S	M	S	S
CO4	S	S	S	S	M	S	S

### Mapping of COs with PSOs

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

S:Strong M:Medium L: Low

1. Isolation of genomic DNA from Onion/Cauliflower
2. Isolation of genomic DNA from bacteria
3. Isolation of Plasmid DNA from bacteria
4. Agarose gel electrophoresis of chromosomal and plasmid DNA from *E.coli*
5. Demonstration of PCR
6. Electrophoretic separation of proteins
7. Mitosis cell division in onion root tips
8. Meiotic cell division in *Tradescantia* anthers
9. Isolation of antibiotic resistant bacterial mutants by gradient plate techniques
10. Isolation of UV- B resistant bacterial mutants by gradient plate techniques.



**Thiagarajar College (Autonomous):: Madurai – 625 009**

**Department of Botany**

(For those joined M.Sc. Botany on or after June 2020)

**Programme Code-PBO**

Course Code	Course Title	Category	L	T	P	Credit
PBO20C22	Microbiology and Plant pathology	Core-5	4	1	-	4

L - Lecture                      T - Tutorial                      P - Practicals

Year	Semester	Int. Marks	Ext. Marks	Total
First	II	25	75	100

**Preamble**

To acquire knowledge of handling microbes

**Course Outcomes**

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

#	Course Outcome	Knowledge Level
CO1	Classify the microbes according to their basic features	K1
CO2	Do the culture of microbes from natural sources.	K3
CO3	Practice the culture techniques in future research	K4
CO4	Assess the development of plant disease, host – pathogen interaction and the reasons for an epidemic disease.	K2
CO5	Imbibe the knowledge of different control methods of plant diseases and etiology of some plant diseases	K5

K1 - Knowledge              K2 - Understand              K3 - Apply              K4 - Analyze              K5 - Evaluate

**Mapping of COs with POs**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	S	-	-	-	-	-	-
CO2	-	-	S	-	-	-	-
CO3	-	S	-	-	-	-	-
CO4	S	-	-	-	-	-	-
CO5	-	S	-	-	-	-	-

**Strong(S), Medium(M), Low(L)**

**Mapping of COs with PSOs**

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

## Blooms taxonomy

Blooms Taxonomy	CA		End of Semester Marks
	I Internal Marks	II Internal Marks	
Knowledge -K1	15% (9)	15% (9)	20% (30)
Understand -K2	15% (9)	15% (9)	20% (30)
Apply-K3	30% (18)	30% (18)	20% (30)
Analyze-K4	20% (12)	20% (12)	20% (30)
Evaluate-K5	20% (12)	20% (12)	20% (30)
TOTAL	<b>60</b>	<b>60</b>	<b>150</b>

## Course Title : Microbiology and Plant pathology

**Unit I** Brief history of microbiology, General account of microbes, Archaeobacteria, Eubacteria and cyanobacteria. Prokaryotic and eukaryotic microbes, Whitaker's five kingdom concept - Classification (Bergey's manual of systematic Bacteriology). Bacteria: Ultra structure, binary fission and bacterial diseases- Tetanus, TB, Cholera. Viruses: general structure-classification-transmission-multiplication: T<sub>4</sub>-bacteriophage, animal viruses- Pox, Mumps, Corona viruses. Plant viruses- TMV, CaMV and PSV.

**Unit II** Sterilization techniques and different types of staining methods- Pure culture techniques and culture preservation. Microbial nutrition: nutritional groups and Culture media-types. Microbial growth curve and measurement of growth by cell numbers and cell mass- Factors influencing growth - Continuous growth: Chemostat and Turbidostat.

**Unit III** Soil microbiology: Microbial interactions-Mutualism, Commensalism, Parasitism and symbiosis. Microbial associations: Neutral, negative. Microbial enzymes-Food spoilage and its preservation. Aquatic microbiology-Microbes in fresh water and marine environment-Water borne pathogens and its infection-Water analysis-Coliform test- Waste water treatment, Biomining – biofilms – superbugs.

**Unit IV** Principles and concepts in phytopathology- classification of plant diseases based on symptoms, Early detection and diagnosis of plant diseases. Infection process: Mode of Entry of pathogen-establishment of pathogen (enzymes and toxins). Defence mechanism: Structural and biochemical. Epidemiology: Forms of epidemics, conditions governing epidemics, reasons for progressive severity of epidemics and decline of epidemics-concept of post harvest diseases and its management.

**Unit V** Plant Disease Control methods: Cultural practices, Quarantine, Chemical control (Pesticide, fungicide and antibiotics), Biological control of pest and pathogens-transgenic plants diseases: symptoms causative organism, disease cycle and control of following diseases. A) Red rust of tea b) Fungi: Red rot, Paddy Blast, White rust, leaf spot of Ground nut C) Bacteria: Cotton blight, Citrus canker, d) Virus: Bendi Yellow vein clearing virus, cucumber mosaic virus e) Phytoplasma: Brinjal little leaf, *Sesamum* phyllody.

## Text Books:

1. Prescott, L.M. and D.A.Harkey. 1996. Microbiology. Ww. C. Brown Publishers, London.
2. Pommerville, J.C.2006. Alcomals Fundamentals of Microbiology. Jones and Bertlett

- Publishers, London.
3. Atlas, R.M.1995. Principles of Microbiology. Morby Publishers, St. Louis.
  4. Pelczar,M.,E.C.S.Chan nad N.R.Krieg.1993.Microbiology-concepts and Applications. Tata Mc-Graw Hill Ltd., Inc., NewYork.
  5. Stanier, R.Y., J.L.Ingrahm, M.L. Wheelis and P.R. Painter.1990. The Microbial World, Prentice Hall of India Pvt. Ltd. New Delhi.
  6. Mehrotra, R.S.1980. Plant Pathology. Tata McGraw-Hill Publishing Company Ltd., New Delhi.
  7. Pandey, B.R.1997. Plant Pathology. S. Chand and company, New Delhi.
  8. Agrios,G.N. 2006. Plant Pathology, Fifth Edition, Academic Press, New York.
  9. M.L. Gullinio, spinger, 2014 Detection and diagnosis of plant diseases.

#### References:

1. Alexopolus, C.J. and Mims, C.W.1979. Introductory Mycology. III Edition. Wiley Eastern Ltd. New Delhi.
2. Rengasamy, G. 1979. Disease of crop plants in India. III edi., Prentice Hall of India, Pvt Ltd,New Delhi.
3. Prescott, L.M., Harley , J.P. nad Klein, P.A. 1993. Microbiology. W.M.C. Brown publishers, IOWA, USA.
4. Patel, A.H. 1985. Industrial Microbiology, Macmillan India Ltd. New Delhi.
5. Purohit, S.S.1995. Microbiology-Fundamantals and applications, V Ed. Agrobotanical Publishers, Bikaner.

#### Web Resources:

1. [http://highered.mheducation.com/sites/0072320419/student\\_view0/chapter1/chapter\\_web\\_links.html](http://highered.mheducation.com/sites/0072320419/student_view0/chapter1/chapter_web_links.html)
2. [http://www.freebookcentre.net/medical\\_books\\_download/General-Microbiology-by-Rachel-Watson.html](http://www.freebookcentre.net/medical_books_download/General-Microbiology-by-Rachel-Watson.html)
3. <https://ocw.mit.edu/courses/biological-engineering/20-106j-systems-microbiology-fall-2006/lecture-notes/>

#### Course Designers:

1.Dr.B.Sadhana

**Thiagarajar College (Autonomous):: Madurai – 625 009**  
**Department of Botany**  
 (For those joined M.Sc.Botany on or after June 2020)  
**Programme Code-PBO**

Course Code	Course Title	Category	L	T	P	Credit
PBO20CL22	Microbiology and Plant pathology lab	Core Lab 5	-	-	4	2

L - Lecture                      T - Tutorial                      P - Practicals

Year	Semester	Int. Marks	Ext. Marks	Total
First	II	40	60	100

**Preamble**

To acquire knowledge of handling microbes

**Course Outcomes**

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

#	Course Outcome	Knowledge Level
CO1	Aware the healthy lab practices	K1
CO2	Explain the media preparation for microbial culture	K2
CO3	Practice the staining methods	K3
CO4	Analyze and develop the skills for isolation of microbes from infected plant materials and other samples	K4
CO5	Examine the different control measures in field trials	K5

K1 - Knowledge              K2 - Understand              K3 - Apply              K4 - Analyze              K5 - Evaluate

**Mapping of COs with POs**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	S	-	-	-	-	-	-
CO2	-	S	-	-	-	-	-
CO3	-	-	S	-	-	-	-
CO4	-	-	-	-	S	-	-
CO5	-	-	-	-	-	S	-

**Strong(S), Medium(M), Low(L)**

**Mapping of COs with PSOs**

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

1. Preparation of media and pure culture technique.
2. Staining methods: Acid fast staining, Gram staining, Negative staining, Endospore staining and Staining of poly- $\beta$  hydroxyl butyrate granules.
3. Motility of bacteria-Hanging drop method.
4. Determining bacterial growth-turbidometric and haemocytometer method.
5. Bacterial analysis of water-coliform test- presumptive, confirmative and completed test.
6. Microbial production of extra cellular enzymes-Amylase and catalase.
7. Dye reduction test for milk.
8. Isolation of bacteriophages from sewage.
9. Isolation of *Rhizobium* and *Frankia* from the nodules.
10. Isolation of plant pathogens from infected plant materials.
11. Isolation of AM spores by wet sieving-decanting method.
12. White rust disease.
13. Leaf spot of ground nut.
14. Citrus canker and Red rot of sugarcane
15. Collection of plant pathology specimens-10 sheets to be valued externally

**Thiagarajar College (Autonomous): Madurai – 625 009**  
**Department of Botany**  
 (For those joined M. Sc., Botany on or after June 2020)  
**Programme Code-PBO**

Course Code	Course Title	Category	L	T	P	Credit
PBO20C23	Computer Applications in Biology and Biostatistics	Core-6	4	-	-	4

L - Lecture                      T - Tutorial                      P - Practicals

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

### Preamble

To acquire knowledge and computing, statistical calculation skills

### Course Outcomes

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

#	Course Outcome	Knowledge Level
CO1	Recognize various applications of computer knowledge in biology	K1
CO2	Evaluate the tools and programmes of bioinformatics in their research	K2
CO3	Perform basic statistical analysis of data	K3
CO4	Apply appropriate statistical tool in the problem solving	K4
CO5	Acquire talents and skills on basics and advance level computational biostatistics to their research projects	K5

K1 - Knowledge      K2 - Understand      K3 - Apply      K4 - Analyze      K5 - Evaluate

### Mapping of COs with POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	S	L	M	M	M	M	L
CO2	S	S	S	M	M	M	M
CO3	S	S	S	S	S	L	M
CO4	S	S	S	S	S	L	M
CO5	S	S	S	S	S	L	M

Strong(S), Medium(M), Low(L)

### Mapping of COs with PSOs

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

## Blooms taxonomy

Blooms Taxonomy	CA		End of Semester Marks
	I Internal Marks	II Internal Marks	
Knowledge -K1	15% (9)	15% (9)	20% (30)
Understand -K2	15% (9)	15% (9)	20% (30)
Apply-K3	30% (18)	30% (18)	20% (30)
Analyze-K4	20% (12)	20% (12)	20% (30)
Evaluate-K5	20% (12)	20% (12)	20% (30)
TOTAL	<b>60</b>	<b>60</b>	<b>150</b>

## Course title: Computer Applications in Biology and Biostatistics

**Unit I:** Introduction to computer-- Computer Operating Systems - Windows and Linux--Search engines: Google and Yahoo - Internet and its application - Basics of Bioinformatics – Database concepts: Biological Sequence Databases: Primary, Composite, Secondary or Pattern databases (General Account). Information retrieval systems: PubMed, NCBI.

**Unit II:** Overview on Nucleotide Sequence databases (Genbank, EMBL, DDBJ) and Protein sequence databases(SWISS PROT, PIR, PDB, SCOP, CATH). Sequence alignment: local and global alignment, Pairwise sequence alignment – FASTA and BLAST, Multiple sequence alignment- CLUSTAL W, Homology Modelling, Phylogeny Tree Analysis – Treeview and Phylip. Introduction to CADD (Computer aided drug designing).

**Unit III.** Biostatistics--Scope and application. Data collection and Sampling Methods--Merits and demerits, Data presentation methods. Measures of central tendency: Mean median and mode - Concept, formula with problems and solving methods; Measures of dispersion: Mean deviation, Standard deviation, Co-variance, Coefficient of variations – Concept, formula with problems and solving methods – Computer Application programmes for statistics – EXCEL and SPSS package.

**Unit IV:** Correlation--concept and applications--Karl Pearson coefficient of correlation--Formula with problems and solving method. Regression: linear regression – concept and application – Formula with problems and solving method. Hypothesis testing - null and alternative hypothesis – Errors – Type I and Type II; Test of Significance: Student's  $t$  Test, F test and chi-square test (derivations not required) – Formula, problems with solving methods – Application in Biological Sciences

**Unit V:** Probability theory--Basic concept - Probability distributions: Binomial, Poisson and Normal – Problems with solving procedure - Applications, ANOVA – Principle – One-way, Two-way methods – Comparison of means: - LSD and DMRT - Problems with solving methods – Applications in Bioresearch.

## Text Books:

**Author name, initial, year of publication, name of the book, publisher, place**

1. Chiranjib Chakraborty.2010. Bioinformatics: Approaches & Applications, Daya Publishing, New Delhi. Arora, P.N. and Malhan, P.K. 2011. Biostatistics, Himalaya Publishing House, New Delhi,
2. Bryan Bergeron. 2006. Bioinformatics Computing, Prantice-Hall of India Pvt. Ltd., New Delhi
3. ChiranjibChakraborty. 2010. Bioinformatics: Approaches & Applications, Daya Publishing, New Delhi.
4. Khan, I.D. and Khanum, A. 2004. Fundamentals of Biostatistics, Ukasz Publications, Hyderabad, India, 2004

## References:

1. HoomanRashidi and Lukas K. Buehler. 2005. Bioinformatics Basics: Applications in Biological Science and Medicine, Second Edition, CRC Press, Taylor & Francis.
2. Mount, D.W. 2006. Bioinformatics: Sequence and Genome Analysis, University of Arizona, Tucson.
3. Stephen A. Krawetz and David D. Womble. 2003. Introduction to Bioinformatics: A Theoretical and Practical Approach, Humana Press.
4. Khan, I.D. and Khanum, A. 2004. Fundamentals of Biostatistics, Ukasz Publications, Hyderabad, India
5. Zar, J.K. 2011. Bio statistical Analysis, Fourth Edition, Prantice-Hall International, New Jersey, USA.

## Web Resources:

[www.ncbi.nlm.nih.gov](http://www.ncbi.nlm.nih.gov)

[www.slideshare.net](http://www.slideshare.net)

## Course Designers:

1. Dr. D. Kannan
2. Dr. M. Rama Prabha



**Thiagarajar College (Autonomous): Madurai – 625 009**  
**Department of Botany**  
 (For those joined M. Sc., Botany on or after June 2020)  
**Programme Code-PBO**

Course Code	Course Title	Category	L	T	P	Credit
PBO20CL23	Computer Applications in Biology and Biostatistics - Lab	<b>Core Lab 6</b>	-	-	<b>3</b>	<b>2</b>

L - Lecture

T - Tutorial

P - Practicals

Year	Semester	Int. Marks	Ext. Marks	Total
<b>First</b>	<b>Second</b>	<b>40</b>	<b>60</b>	<b>100</b>

1. Nucleotide sequence retrieval from NCBI
2. Comparison of sequences using BLAST
3. Multiple sequence alignment – Clustal W
4. Cladogram method of phylogenetic tree construction
5. Finding measures of dispersion by MS EXCEL
6. Presentation of data (Creation of chart) in EXCEL
7. Student's t-test
8. Karl Pearson's correlation analysis of data
9. Regression analysis
10. ANOVA method of comparing means

**Thiagarajar College (Autonomous):: Madurai – 625 009**  
**Department of Botany**  
 (For those joined 2020-2021 on or after June 2020)

Course Code	Course Title	Category	L	T	P	Credit
PBO20CE21	Research Methodology	Elective 2	5	-	-	5

L - Lecture                      T - Tutorial                      P - Practical

Year	Semester	CA	SE	Total
I	I	25	75	100

**Preamble**

To acquire cognitive knowledge in the Research concept and analytical knowledge

**Prerequisite**

The student must have practical knowledge in Life Sciences at UG level

**Course Outcomes**

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

#	Course Outcome	Knowledge Level
CO1	Comprehend the organized well defined procedures of scientific research	K1
CO2	Adapt holistic approach towards conducting research, data collection and data presentation using tables and graphs	K2
CO3	Familiar with the modern biological techniques and instrumentation handling	K3
CO4	Practice biotechnology and molecular biochemistry techniques	K3
CO5	Survey and organize scientific literature, creating scientific writing and presentation skills, preparation of research articles and for conference presentations and dissertation	K3

K1 - Knowledge

K2 - Understand

K3 – Apply

**Mapping of COs with POs**

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

**Strong(S), Medium(M), Low(L)**

**Mapping of COs with PSOs**

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

## Blooms Taxonomy

	CA		End of Semester
	First	Second	
Knowledge -K1	15% (9)	15% (9)	20% (30)
Understand -K2	15% (9)	15% (9)	20% (30)
Apply-K3	30% (18)	30% (18)	20% (30)
Analyze-K4	20% (12)	20% (12)	20% (30)
Evaluate-K5	20% (12)	20% (12)	20% (30)
<i>Total</i>	60	60	150

## Course Title: Research Methodology

**Unit - I:** Research Process: Generating Research Ideas, Developing a research project structure of a research proposal, Organising Survey and Interviews, Collection of Data - Sampling design and Techniques; Research Design - Deduction and Induction causality - Dialectical Materialism – Models - Research methods - historical, theoretical and empirical - case study - objectivity in research.

**Unit – II:** Sampling Methods – Number and Complete Random Block Design Data collection – Random and Non-random methods; Data representation – Table – simple and multiple forms, Graphical forms – Scatter, Line, Bar, pie chart, histogram, polygon, area, standard error bar, Significance and confidence level and its representation.

**Unit – III:** Principles and Applications: Atomic Adsorption Spectroscopy, Inductively coupled plasma emission spectroscopy - Chromatography – Column, TLC, UPLC – sample preparation, selection of solvents and columns, Elution, Detection methods.

**Unit IV-** Plant Tissue Culture Techniques –Explants choice and preparation for callus culture, embryo culture; maintenance of callus; clonal propagation, hardening and transplanting – Isolation and haploid plants production, cybrid production, seed and embryo encapsulation techniques; Liquid culture techniques and secondary metabolite production.

**Unit V:** Conference, Workshop, Group Discussion, Symposium Task Force Meetings – Significance; Research and Popular Article writing, Poster preparation, Dissertation and thesis writing – Components, Introduction, Literature Review, Discussion, format and writing, preparing tables, figures and Bibliography – Search Tools and usage – Google Scholar, Mendely, Infilbnet, Citation Index – h' index and i -10 index – calculation method and significance.

## Text Books:

Ranjit Kumar, Research Methodology, Pearson Education India  
Arumugam, N. Research Methodology for Life Sciences, Saras Publications,  
Mishra Shanthi Bhusan, 2015, Handbook of Research Methodology - A Compendium for Scholars & Researchers , Ebooks2go Inc.  
Gurumani, N. 2019. Research Methodology: For Biological Sciences, MP. Publishers  
P.S. Narayana, D. Varalakshmi, T. Pullaiah, 2016, Research Methodology in Plant Science, Scientific Publishers, Jaipur, Rajasthan.

## References:

Vogel “(2004). Text book of Quantitative inorganic analysis, Bence J Denney, R.C. Jeffery, G.H. and Mendham J. Longman Scientific and Technical U.K.

Joseph Brook and David W Russell, Molecular cloning – A laboratory manual 3<sup>rd</sup> edition- Cold Spring Harbor Laboratory Press, New York.

Richa Arora, 2004, Encyclopaedia of Research Methodology in Biological Sciences, Anmol Publishers, New Delhi

## Web Resources:

Bibliography: A Guide to the Life Sciences <https://www.jstor.org/stable/301921>

Literature Search from within Mendeley Desktop <https://blog.mendeley.com/2013/07/08/new-release-literature-search-from-within-mendeley-desktop/>

## Course Designer::

Dr. D. Kannan

# **M.Phil. Botany**

**Programme Code : MBO**



## **Programme outcome-PO (Aligned with Graduate Attributes) - Master of Philosophy (M.Phil.)**

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### **Knowledge and critical thinking**

Acquire, analyse, evaluate and interpret data using appropriate techniques. Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

### **Problem solving**

Critically evaluate information and ideas from multiple perspectives. Employ conceptual, analytical, quantitative and technical skills in solving the problems and are adept with a range of technologies

### **Complementary Skills**

Recognize the need for information, effectively search for, retrieve, evaluate and apply that information gathered in support of scientific investigation or scholarly debate.

### **Communication efficiency**

Communicate and disseminate clearly and convincingly the research findings effectively in the academic community and to stakeholders of their discipline in written and or oral form. Elaborate on the ideas, findings and contributions in their field of interest to expert and non-expert audiences.

### **Environment, Ethical and Social relevance**

Apply ethical principles for societal development on environment context. Demonstrate the knowledge of and need for sustainable development.

### **Life-Long Learning**

Recognize the need, and have the ability, to engage in continuous reflective learning in the context of technological advancement.

### **Team work**

Work effectively in teams, both collaboratively and independently to meet a shared goal with people whose disciplinary and cultural backgrounds differ from their own. Engage in intellectual exchange of ideas with researchers of other disciplines to address important research issues





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

### Vision

Provision of knowledge to contribute towards the sustainable utilization of Plant Biosphere

### Mission

- To foster an environment of excellence by providing a comprehensive set of courses in plant sciences that enhances the understanding, depth of knowledge and technical competency of the students.
- To provide the students competence for entry-level research and teaching positions in biological sciences.
- To inculcate the students with an environment that fosters the development of appropriate scientific vocabulary, reasoning skills, and effective oral and written communication abilities for students.
- To create a holistic understanding of the allied subjects through interdisciplinary learning.

### Programme Educational Objectives (PEO)

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

<b>PEO1</b>	To develop competent knowledge in Plant sciences, required for unremitting learning and research.
<b>PEO2</b>	To develop diversified basic professional skills through, experimental designs, field trails, laboratory analysis
<b>PEO3</b>	To make the students with an ability to identify, formulate, and solve problems pertinent to the research topic, directly relevance to the branches of Plant Sciences, serving to community development
<b>PEO4</b>	To integrate with all related topics from all the off-shoot branches of the core Botany with Research Methodology, Biodiversity and Conservation Biology and Signalling Molecules, making them to their much fruitful career.
<b>PEO5</b>	To be proficient with the research and development, further enabling them to choose for doctoral programme and research oriented employment.

### Programme specific outcomes- M.Phil., Botany

On the successful completion of M.Phil., Botany, the students will be able to

<b>PSO1</b>	Formulate a research plan on the topic, in which the student undertakes the research topic
<b>PSO2</b>	Develop experimental methodology and organization of the research protocol, for its systematic execution
<b>PSO3</b>	Exhibit proficient laboratory skills and in contemporary and advance techniques and data collection, with the special reference to the specific research topic
<b>PSO4</b>	Exhibit proficiency in the areas of biostatistics and computer applications in their data analysis and
<b>PSO5</b>	Demonstrate the skill of data analysis, documentation and writing research papers, conference presentation skills with the inculcated art of omitting Plagiarism



**THIAGARAJAR COLLEGE, MADURAI – 9.**  
**(Re-Accredited with ‘A’ Grade by NAAC)**  
**Department of –Botany**  
**Master of Philosophy (M.Phil.) Botany (w.e.f. 2020 batch onwards)**  
**Programme Code-MBO**  
**Programme scheme and scheme of**

**valuation I semester**

Course	Code	Subject/Paper	Contact Hrs / week	credits	Total Hrs	Max Mark	Max Mark	Total
						CA	SE	
Core 1	MBO20C11	Research Methodology and Bio-Instrumentation	6	6	90	100	100	200
Core 2	MBO20C12	New Vistas in Conservation Biology	6	6	90	100	100	200
Core 3	MBO20C13	Biomolecules and Signal Transduction in Plants	6	6	90	100	100	200

**II semester**

Course	Code	Subject/Paper	Contact Hrs / week	Credit	Total hrs	Max Mark	Max Mark	Total
						CA	SE	
Core Elective	MBO20PJ21	Dissertation*	-	6	6	--	100	100
		Viva voce**	-	-	--	50	50	100

\*Dissertation to be valued by two external examiners separately for 50 marks each.

There will be a viva voce examination after valuation of dissertation, to be conducted by the board of examiners comprising of internal examiner (guide) and external examiner.



**Thiagarajar College (Autonomous):: Madurai – 625 009****Department of Botany**

(For those joined M. Phil., Botany on or after June 2020)

**Programme Code MBO**

Course Code	Course Title	Category	L	T	P	Credit
MBO20C11	Research Methodology and Bioinstrumentation	Core - 1	6	-	-	6

Year	Semester	Int. Marks	Ext.Marks	Total
First	First	100	100	100

**Preamble**

To familiarize plant diversity, complexity and its significance.

**Course Outcomes**

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

#	Course Outcome	Knowledge Level
CO1	undertake research through peer guidance	K1
CO2	apply Biotechniques in the classical and advanced research fields of Plant Biology	K2
CO3	apply the statistical concepts to solve the research methodology	K3
CO4	prepare scientific reports, dissertation, oral and poster presentation	K4
CO5	have awareness on plagiarism and get to know for the self-preparation	K5

**Mapping of COs with POs**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	S	S	M	S	L	S	S
CO2	M	S	L	M	M	S	S
CO3	L	L	M	S	M	S	S
CO4	S	S	L	S	M	S	S
CO5	L	S	M	S	M	S	S

**Mapping of COs with PSOs**

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

S;Strong M:Medium L: Low

<b>Blooms Taxonomy</b>			
	<b>CA</b>		<b>End of Semester Marks</b>
	<b>I Internal</b>	<b>II Internal</b>	
Knowledge -K1	20	20	-
Understand -K2	20	20	40
Apply-K3	20	20	40
Analyze-K4	20	20	40
Evaluate-K5	20	20	40
Create-K6	20	20	40
<b>TOTAL</b>	<b>120</b>	<b>120</b>	<b>200</b>

**Course Title: Research Methodology and Bioinstrumentation**

**Unit 1:** Laboratory rules and General Safety measures. Chemical Hazards. Physical Hazards. Biological Hazards. Spillage and Waste Disposal. Laboratory- acquired infections. First Aid. Safety measures. Microscopy: Structure, working principle and applications of Fluorescence microscope, Transmission electron microscope (TEM) and Scanning Electron microscope (SEM). Preparation of materials for SEM and TEM. Spectroscopy: Structure, working principle and applications of FTIR and NMR Spectrophotometer, Mass Spectroscopy-MALDI-TOF.

**Unit 2:** Chromatographic Methods: Nature of Phases. Principles of Separation. Geo-metry and Stationary Phase. Mode of Operation. Retention Mechanism. Thin Layer, Column, Gas and Liquid Chromatography techniques and their Applications. Electrophoresis: Principles, Components, Support Medium, Buffers, Types of Electrophoresis and their Applications. Horizontal and Vertical Gel Electrophoresis. Polyacrylamide Gel Electrophoresis, Two dimensional PAGE. Iso-electric Focusing.

**Unit 3:** Research design—Introduction, Basic principles of Experiments- Hypothesis and Null Hypothesis. Need of research design—Features of good design – Important concepts relating to research design – Observation and Facts, Laws and Theories, Prediction and explanation, Induction, Deduction, Development of Models. Developing a research plan - Exploration, Description, Diagnosis and Experimentation. Writing of a project proposal

**Unit 4:** Statistical methods: principles of Experimental designs—Randomized and non-randomized block designs – ANOVA: One way and two way methods – Students  $t$ , LSD and chi-square tests Simple and linear regression- and correlation- Principle statistical method and interpretation Theoretical Distribution – Normal, Binomial and Poisson; Computation for Statistics: MS Excel and SPSS-PC

**Unit 5:** Presenting Research Work: Literature collection- Identifying Journals and e-journals - Literature citation. Research reports, Dissertation and manuscript preparation for journals - Components, tables, figures and References – Seminars, Conferences and Symposia: Variations- Oral and Poster presentation – Panel discussion – Plagiarism: Concept, Advantages of avoidance, Negative impacts of indulgence - preventive measures. Metrics in research- H-index, Citation index, Impact factor/global impact factor of journals

## **References:**

- Pyrczak, F. and Bruce, R. 2017 (8<sup>th</sup> Edition), Routlage Publishers, USA.
- Rosner, B. 2010. (11<sup>th</sup> Edition) Fundamentals of Biostatistics, Brooks and Cole Publishers, UK.
- Jayaraman.J.1981. *Laboratory Manual in Biochemistry*. Wiley Eastern Limited, New Delhi.
- Einspruch, E.L. 2005. (2<sup>nd</sup> Edition) An Introductory Guide to SPSS for Windows, SAGE Publications, New Delhi
- Shaw, V. 1977. Reporting *Research Papers on Survey Research Methodology Series*. The Agricultural Development Council, New York.
- Webster. J.G. 2004 (editor). *Bioinstrumentation*. John Wiley & sons (Asia) Pvt.. Ltd., Singapore.
- Whitney, F.L.2004. *The Elements of Research*. Prentice- Hall, Englewood, N.J.
- Barry Gilmore, B. 2998. Plagiarism: Why it Happens, how to prevent it. Heinman Publishers

**Thiagarajar College (Autonomous):: Madurai – 625 009**

**Department of Botany**

(For those joined M. Phil., Botany on or after June 2020)

**Programme Code MBO**

Course Code	Course Title	Category	L	T	P	Credit
MBO20C12	New Vistas in Conservation Biology	Core - 2	6	-	-	6

Year	Semester	Int. Marks	Ext.Marks	Total
First	First	100	100	100

**Preamble**

To familiarize plant diversity, complexity and its significance

**Course Outcomes**

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

#	Course Outcome	Knowledge Level
CO1	define various aspects of biodiversity	K1
CO2	explain significance of biodiversity and its conservation	K2, K4
CO3	apply the biosafety principles in research	K2, K6
CO4	Utilize the principles of remote sensing	K3,K6
CO5	Devise conservation strategies	K3,K5

K1 – Knowledge K2 - Understand K3 - Apply K4 - Analyze K5- Evaluate K6 - Evolve

**Mapping of COs with POs**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	S	S	M	S	S	S	S
CO2	S	S	L	S	M	S	S
CO3	S	S	M	S	M	S	S
CO4	S	S	L	S	M	S	S
CO5	S	S	M	S	M	S	S

**Mapping of COs with PSOs**

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

S;Strong M:Medium L: Low



<b>Blooms Taxonomy</b>			
	<b>CA</b>		<b>End of Semester Marks</b>
	<b>I Internal</b>	<b>II Internal</b>	
Knowledge -K1	--	--	--
Understand -K2	20	20	-
Apply-K3	20	20	40
Analyze-K4	20	20	40
Evaluate-K5	20	20	40
Create-K6	20	20	40
<b>TOTAL</b>	20	20	40

**Unit 1:** Biodiversity- Concept, spatial and temporal aspects of Biodiversity. Rain forest as centers of diversity – Ecological diversity in coastal zones and oceans. Measures of Biodiversity: Alpha. Beta and gamma diversity. Diversity indices: Dominance and evenness. Diversity crises in the geological past.

**Unit 2:** Values of biodiversity-ecosystem services- screening plants for medicines- New agricultural and industrial products from the tropics- identifying and protecting the origin of food crops. Speciation- species area relationship: productivity- diversity relationship - Biodiversity hot spot.

**Unit 3:** Biological responses for global climate change- species invasion- Minimum viable populations and extinction debt - IUCN categories of extinction- red data book – causes for species extinction – impact of exotic species on native species – GMOs and biosafety – Intellectual property rights- GATT, WTO, farmers and breeders rights- Biodiversity act 2002.

**Unit 4:** Remote sensing: Introduction-Analysis techniques-Digital image processing- Role of remote sensing in biodiversity management-GIS and biodiversity, landscape elements, Oceans colour and fishery, water security. Environment assessment and monitoring. Sensing Natural disasters - Tsunami, Earth quake, Landslides, drought, flood, cyclones

**Unit 5:** Conservation: In *situ* and *Ex situ* conservation methods- conservation of biological diversity in Botanical gardens- Information management for the conservation of biodiversity. Cryobiology-Agro ecology and *in situ* conservation of native crop diversity- International development and the protection of biodiversity.

### **References:**

- Stiling, P. 2002. Ecology – Theory and applications. Prentice-Hall of India Pvt. Ltd., New Delhi.
- Gurevitch, J., Scheiner S.M and Fox G.A. 2002. The Ecology of Plants. Sinauer Associates Inc Publishers, Massachusetts.
- Cunningham, W.P. and Cunningham, M.A. 2002. Principles of environmental science. Tata McGraw-Hill Publishing Company Ltd., New Delhi.
- Agarwal, K.C. 2000 Biodiversity. Agrobios (India). Jodhpur
- Odum, E.P. 1971 Fundamentals of Ecology. W.B. Saunders Company, London.
- Colinvaux, P. 1986. Ecology John Wiley and sons, Singapore.
- Krishnamoorthy, K.V. 2004 An advanced Text Book of Biodiversity. Oxford & IBH Publishing Co, Pvt. Ltd., New Delhi.
- Meffe, G.K. and Carrol, R.C. 1994. Principles of Conservation of Biology, Sinauer Associates, Inc., Publishers, Sand

**Thiagarajar College (Autonomous):: Madurai – 625 009**

**Department of Botany**

(For those joined M. Phil., Botany on or after June 2020)

**Programme Code MBO**

Course Code	Course Title	Category	L	T	P	Credit
MBO20C13	Biomolecules and signal transduction in Plants	Core - 3	6	-	-	6

Year	Semester	Int. Marks	Ext.Marks	Total
First	First	100	100	100

**Preamble**

To familiarize biomolecules and their signaling behaviour

**Course Outcomes**

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

#	Course Outcome	Knowledge Level
CO1	explain the structure and functions of biomolecules	K1
CO2	depict the types of bioactive secondary metabolites	K2, K4
CO3	demonstrate quorum sensing	K2,K6
CO4	demonstrate the principles and mechanisms involved in cell signaling and cell communication	K3,K6
CO5	Evolve the mechanism of UV on Signalling	K3, K6

K1 – Knowledge K2 - Understand K3 - Apply K4 - Analyze K5- Evaluate K6 – Evolve

**Mapping of COs with POs**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	S	S	M	S	S	S	S
CO2	S	S	S	M	M	S	S
CO3	S	S	M	S	M	S	S
CO4	S	S	S	S	M	S	S
CO5	S	S	M	S	M	S	S

**Mapping of COs with PSOs**

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

S;Strong M:Medium L: Low

<b>Blooms Taxonomy</b>			
	<b>CA</b>		<b>End of Semester Marks</b>
	<b>I Internal</b>	<b>II Internal</b>	
Knowledge -K1	20	20	-
Understand -K2	20	20	40
Apply-K3	20	20	40
Analyze-K4	20	20	40
Evaluate-K5	20	20	40
Create-K6	20	20	40
<b>TOTAL</b>	<b>120</b>	<b>120</b>	<b>200</b>

**Unit I:** Biomolecules and biomacromolecules (brief account)— secondary metabolites and their characteristic features – major groups of plant and microbial secondary metabolites – Bioactivities: antimicrobial, antioxidant, pharmacological, agricultural activities, microbial regulators, and biophysical effects – Bioactive compounds as Nutraceuticals, functional foods and dietary supplements.

**Unit II:** Biological Databases and its Types: General Introduction of Biological Databases- Nucleic acid databases (NCBI, DDBJ, and EMBL). Protein databases (Primary, Composite, and Secondary). Specialized Genome databases: (SGD, TIGR, and ACeDB). Structure databases (CATH, SCOP, and PDBsum)

**Unit III:** Cell Signaling molecules: Bioactive molecules in cell signaling–G- proteins, Phosphoinositides, ITP, MAP and CD Kinases. Plant hormones as signal molecules: Salicylic acid, Jasmonic acid, Ethylene, Auxin, Abscisic acid, Brassinosteroids and Systemin. Signal receptors: Cell surface receptors and signaling through G-protein coupled receptors. Signal transduction pathways

**Unit IV:** Light signaling in plants: photobodies, photoreceptors-types, photosynthetic pigments, phytochromes, cryptochromes. Florigen concept. UV-RB protein in UV-B signaling. Symbiotic nitrogen fixation – role of signaling molecules and receptors in nodule induction.

**Unit V:** Signal transduction in plants: Host parasite interaction–Recognition and entry processes of different pathogens like fungi, bacteria, viruses into plant host cells, alteration of host cell behaviour by pathogens, virus- induced cell transformation, cell-cell fusion in both normal and abnormal cells

## References:

- Watson, J.D., Hopkins, N.H., Roberts, J.W., Steitz, J.A. and Weiner, A.M. 1987. Molecular Biology of the Gene, 4<sup>th</sup> Edition, Benjamin/ Cummings Publishing Company, California.
- Kendrick, R.E. and Kronenberg, G.H.M.1994. Photomorphogenesis in plants, 2<sup>nd</sup> Edition, Kluwar Academic Publishers, Dordrecht.
- Taiz, L. and Zeiger, E. 2002. Plant Physiology. The Benjamin and Cummings Publishers, California.
- Mc.Donald, M.S. 2003. Photobiology of Higher Plants, John Wiley & Sons, Inc., West Sussex.

- Roy, S.C. and Kalyan Kumar De. 2005. Cell Biology, 2<sup>nd</sup> Edition, New Central Book Agency (P) Ltd, Kolkata.
- Desikar, R.N. 2005. Cell and Development Biotechnology, Dominant Publishers and Distributors, New Delhi.
- Jamesway, C.A., Travers, P. Walport, M. and Sholmchik, M.J. 2005. Immunobiology and the Immune System in Health and Diseases, Garland Science Publishers, New York.
- Bradshaw, R.A. and Dennis, E.A. 2008. Handbook of Cell Signaling Three-Volume Set (e book). [http://ebookey.org/Handbook-of-Cell-Signaling-Three-Volume-Set\\_175281.html](http://ebookey.org/Handbook-of-Cell-Signaling-Three-Volume-Set_175281.html)
- Baluka, F. and Vivanco, J. 2012. Signaling and Communication in Plants (e book). <http://freshbookers.com/ebook/9783642230462/ISBN>

**Thiagarajar College (Autonomous):: Madurai – 625 009**

**Department of Botany**

(For those joined M. Phil., Botany on or after June 2020)

**Programme Code MBO**

<b>Course Code</b>	<b>Course Title</b>	<b>Category</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credit</b>
MBO20CE21	Project work and viva voce			-	-	6

<b>Semester</b>	<b>Int. Marks</b>	<b>Ext.Marks</b>	<b>Total</b>
Second	100	100	200

**Preamble**

Expose to collect and read literature pertaining to their project work. Train the students to do lab exercise individually under the guidance of their project guide

**Prerequisites**

Basic knowledge on the Laboratory techniques related to Life Sciences .Interpretation of data using statistical tools

**Course Outcomes**

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

	<b>Course outcomes</b>	<b>Level</b>
<b>CO1</b>	Collect and analyse the scientific literature from web resources	K1,K2
<b>CO2</b>	Explain the theoretical basis of the tools, technologies and methods common to microbiology;	K2,K5
<b>CO3</b>	Demonstrate practical skills in the use of tools, technologies and methods common to microbiology,	K3,K4
<b>CO4</b>	Apply the scientific method and hypothesis testing in the design and execution of experiments.	K3,K6
<b>CO5</b>	Construct a summative project or paper that draws on current research, and/or techniques in life sciences.	K5

K1 – Knowledge K2 - Understand K3 - Apply K4 - Analyze K5- Evaluate K6 - Evolve

**Mapping of COs with PSOs**

	<b>PSO1</b>	<b>PSO2</b>	<b>PSO3</b>	<b>PSO4</b>	<b>PSO5</b>
<b>CO1</b>	S	S	M	S	S
<b>CO2</b>	M	S	M	M	L
<b>CO3</b>	M	M	M	L	S
<b>CO4</b>	S	S	M	S	M
<b>CO5</b>	S	S	M	M	L

**S;Strong M:Medium L: Low**

# **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, 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>	cognize various groups of microbes using specific identification keys and characteristic features.
<b>PSO2</b>	hibit 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>	entify somaclones and gametoclones using appropriate molecular markers and bioinformatics tools.
<b>PSO4</b>	monstrate the principles of inheritance, transgenesis and commercial exploitation of recombinant DNA technology.
<b>PSO5</b>	hibit 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 Botany and 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	இக்கால இலக்கியம்	6	3	90	25	75	100
Part II	U20EN11	English for Comm. I	6	3	90	25	75	100
Core 1	UBT20C11	General Microbiology	5	5	75	25	75	100
Core Lab 1	UBT20CL 11	General Microbiology lab	2	1	30	40	60	100
Core 2	UBT20C12	Elements of Biotechnology	3	3	45	25	75	100
Generic Elective	UBT20GE 11	Bioinstrumentation	4	4	60	25	75	100
Generic Elective lab1	UBT20GL 21	Bioinstrumentation Lab	2	-	30			
AECC	U20ES11	Environmental Studies	2	2	30	15	35	50
Total			30	21				650

**Semester -II**

Course	Code No.	Subject	Hrs/ Week	Credits	Total Hrs	Max Mark CA	Max Mark SE	Total
Part 1	U20P121	பக்தி இலக்கியமும் சிறுநிலக்கியமும்	6	3	90	25	75	100
Part II	U20EN11	English for Comm II	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	U20VE21	Value Education	2	1	30	15	35	50
Total			30	22				750

### 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	U20EN11	English for Comm III	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	UBT20CL31	Molecular Biology & Computational Biology Basics lab	2	1	30	40	60	100
Generic Elective3	UBT20GE31	Genetics & Biostatistics	4	4	60	40	60	100
Generic Elective lab 3	UBT20GL41	Genetics & Biostatistics lab	2	-	30	-	-	-
NME1	UBT20NE31	Mushroom Technology	2	2	30	15	35	50
Total			30	21				650

### 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	U20P241	English	6	3	90	25	75	100
Core 7	UBT20C41	Immunology and Immunotechniques	4	4	45	25	75	100
Core 8	UBT20C42	Clinical Laboratory Technology	4	4	45	25	75	100
Core lab 4	UBT20CL42	Immunology and Immunotechniques & Clinical laboratory technology lab	2	1	30	40	60	100
Generic Elective4	UBT20GE41	Physiology and Pathology	4	4	60	25	75	100
Generic Elective lab 3&4	UBT20GL41	Genetics and Biostatistics & Physiology lab	2	2	30	40	60	100
NME2	UBT20NE41	Vocational Biotechnology	2	2	30	15	35	50
Total			30	23				750

**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	4	4	60	25	75	100
Core 11	UBT20 C53	Marine Biotechnology	4	4	60	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	4	2	60	40	60	100
Core lab 7	UBT20 CL53	Marine Biotechnology lab	3	2	45	40	60	100
Core Elective 1	UBT20 CE51 A/B/C	(A) Applied Microbiology (B) Metabolic pathways (C) Pharmaceutical Biotechnology	4	5	60	25	75	100
SEC 1	UBT20 SE51 (A/B/C/D)	Biomedical Sciences/ Environmental Chemistry/ Biofertilizers and Biopesticides / Agricultural Biotechnology	2	2	30	15	35	50
Total			30	26				750

**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	4	4	60	25	75	100
Core lab 8	UBT20CL61	Plant Conservation Biotechnology Practical	3	2	45	40	60	100
Core lab 9	UBT20CL62	Animal Biotechnology lab	3	2	45	40	60	100
Core lab10	UBT20CL63	Environmental Biotechnology lab	4	2	60	40	60	100
Core Elective 2	UBT20 CE61 (A/B/C)	Forensic Biotechnology/ Genomics and Proteomics/ Biosafety&IPR	4	5	60	25	75	100
SE C2	UBT20 SE61 (A/B/C/D)	Bioprospecting/ Health & Hygiene/ Entrepreneurs in Biotechnology / Nano Biotechnology	2	2	30	15	35	50
Part V			-	1				
Total			30	28				750

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

**B) Curriculum Credits: Part wise**

		No of papers	Credits per paper	Total credits
Part I	Tamil	4	3	12
Part II	English	4	3	12
Part III	Core Theory	8+6	4/5	58
	Core lab	10	1/2	16
	Core Elective	2	5	10
	Generic Elective Theory	4	4	16
	Generic Elective lab	2	2	4
Part IV	AECC/VE	2	2+1	3
	NME	2	2	4
	SEC	2	2	4
Part V (NSSNCC/Physical Education)				1
Grand total				140

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

**Programme Code-UBT**

Course Code	Course Title	Category	L	T	P	Credit
UBT20C11	General Microbiology	Core-1	5	-	-	5

L – Lecture                      T – Tutorial                      P- Practicals

Year	Semester	Internal Marks	External Marks	Total Marks
I	1	25	75	100

**Preamble**

To enable students to acquire an exposure to the classification of microorganisms, diversity of microbial structure and the nutritional types of bacteria.

**Course Outcomes**

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

#	Course Outcome	Knowledge Level
CO1	Define the differences between prokaryotes & eukaryotes, appreciate the contribution of scientists.	K1
CO2	Acquire an exposure to the classification of microorganisms, diversity of microbial structure and their role.	K2
CO3	Explain the structure of Bacteria, appreciate the importance of pure culture techniques.	K2
CO4	Categorize the nutritional types of Bacteria.	K3
CO5	Demonstrate the structure of viruses and their replication.	K3

K1 - Knowledge

K2 - Understand

K3 - Apply

**Mapping of COs with POs**

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

S (+++) – Strong

M (++)- Medium

L (+) - Low

**Mapping of COs with PSOs**

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



## 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    General Microbiology

### Unit: I

Introduction to microbes: Prokaryotes - Algae, fungi, protozoa, and mycoplasma. Differences between prokaryotes and eukaryotes. Important milestones in microbiology: spontaneous generation theory- contributions of Leewenhoek, Pasteur, Koch – Koch postulates, Paul Ehrlich, Joseph Lister, Tyndall, Jenner, Winogradsky, Beijerinck, Beadle and Tatum, Avery.

### Unit: II

Classification of Bacteria: Characters used in classification. Approaches to Classification- Natural approach, Phylogenetic approach, Numerical approach and Molecular approach. Outline of bacterial classification as per Bergey's manual of determinative bacteriology - eighth edition.

### Unit: III

Morphology and fine structure of bacteria: Structures outer to cell wall, capsule, slime, flagella and pili; structures inner to the cell wall - plasma membrane, cytoplasmic matrix, Cytoplasmic inclusions – poly hydroxyl butyrate (PHB), glycogen, ribosomes, brief account on chromosomes, plasmids and endospore - cell wall-peptidoglycan structure. Culture media: complex & defined media, differential and enriched media- sterilization methods-pure culture techniques.

### Unit: IV

Microbial Nutrition: Macro and Micro Nutrients – nutritional types of bacteria – uptake of nutrients: simple diffusion, facilitated diffusion, ABC transporter and group translocation. Microbial growth: sigmoid growth - diauxic growth- generation time- measurement of microbial growth – continuous growth – synchronous growth - factors affecting growth.

### Unit: V

Structure and multiplication of viruses: Classification of Viruses. Plant virus (TMV), Bacteriophage (T4), Animal virus (Pox), Viroids, Virusoids and Prions. Corona Virus - COVID19.

### Text Books:

1. Sharma, P.D. 2005. Microbiology, Second edition. Rastogi publication, Meerut.
2. Daniel, V. Lim. 2002. Microbiology, Revised edition. Kendal, Hunt. 807pp.
3. Pelczar, M. J. Jr., E. C. S. Chan. and N. R. Krieg. 2020. Microbiology, 7<sup>th</sup> edition. Tata Mc Graw Hill publication, New Delhi.
4. Stanier, R. Y. and J. L. Ingraham, Mark L. Wheelis and Rage R. Painter. 2008. General Microbiology, 5<sup>th</sup> edition, Macmillan press Ltd. London.

**Reference Books:**

1. Prescott, L.M., J. P. Harley and D. A. Klein. 2017 Microbiology 10<sup>th</sup> Edition. McGraw Hill Education, New York.
2. Atlas, R. M. 1998. Principles of Microbiology, Second edition. Tata Mc Graw Hill publication, New Delhi.
3. Karl Maramorosch, Aaron Shatkin and Fredrick Murphy.2005.1<sup>st</sup> edition. Academic Press.

**Web sources:**

1. <https://uwyo.libguides.com/biology>
2. <https://microbiologysociety.org/news-press/microbe-post.html>
3. <https://microbiologysociety.org/>

**Course designers:**

**S.Yogachitra S.Siva Durga**

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

CourseCode	Course Title	Category	L	T	P	Credit
UBT20CL11	General Microbiology Lab	Core Lab 1	-	-	2	1

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

Year	Semester	Internal Marks	External Marks	Total Marks
I	1	40	60	100

**Preamble**

Acquire knowledge on media preparation, sterilization and pure culture techniques. Have hands on training on various staining techniques.

**Course Outcomes**

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

#	Course Outcome	Knowledge Level
CO1	Acquire knowledge on preparation of media.	K1
CO2	Apply the knowledge of pure culture techniques.	K3
CO3	Make use of the staining techniques.	K3
CO4	Experiment with various biochemical techniques	K3
CO5	Enumerate the microbial cells	K3

K1 - Knowledge                      K2 - Understand                      K3 – Apply

**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	M	S	L	M	M
CO2	S	M	S	L	M
CO3	S	L	M	S	M
CO4	S	S	M	L	M
CO5	S	L	L	M	L

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

**Title of the paper GENERAL MICROBIOLOGY LAB**

1. Preparation of culture media

2. Isolation of microbes from soil and drinking water.
3. Pure culture techniques: Pour, Spread, Streak plate method, mycelia agar plug method.
4. Micrometry
5. Observation of motility of Bacteria – Hanging drop method
6. Bacterial Staining methods: a) Simple b) Negative c) Acid fast d) Gram's e) spore f) Capsule Staining.
7. Fungal staining with lactophenol cotton blue.
8. Enumeration of microbial count: a) Bacteria-viable count method and b) haemocytometer method. Growth curve.
9. Carbohydrate fermentation
10. IMVIC test
11. Starch hydrolysis
12. Catalase activity
13. Oxidase activity
14. Cellulose hydrolysis.

**Text books:**

1. Maheswari, D.K. 2010. Practical Microbiology. S.Chand & Company, India.
2. Parija, Subhash Chandra. 2007. Textbook of Practical Microbiology, First Edition. Ahuja publishing house, New Delhi.
3. Arora, B. 2007. Practical Microbiology, Second revised Edition. CBS publishers, India.

**Reference books:**

1. Cappucino, Sherman. 2008. Microbiology, A Laboratory Manual. Tenth Edition. Pearson, New York.

**Web sources:**

1. <https://microbiologyonline.org/file/7926d7789d8a2f7b2075109f68c3175e.pdf>
2. [https://www.researchgate.net/publication/257380059\\_Laboratory\\_Manual\\_in\\_General\\_Microbiology\\_For\\_Undergraduate\\_Students\\_Short\\_Version](https://www.researchgate.net/publication/257380059_Laboratory_Manual_in_General_Microbiology_For_Undergraduate_Students_Short_Version)

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

Course Code	Course Title	Category	L	T	P	Credit
UBT20C12	Elements of Biotechnology	Core	3	-	-	3

L - Lecture                      T - Tutorial                      P – Practicals

Year	Semester	Int. Marks	Ext. Marks	Total
I	I	25	75	100

### Preamble

To afford the students with basic knowledge on Biotechnology, milestones in the field of biotechnology and the rationale of its applications with reference to regional, national and global needs.

### Course Outcomes

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

#	Course Outcome	Knowledge Level
CO1	Analyse the rationale of Biotechnology with reference to regional, national and global demand. Appraise the status of Indian Biotechnology industry.	K1
CO2	Illustrate the tools and strategies of gene cloning and selection process	K2
CO3	Analyze the importance of recombinant products and molecular fingerprinting technologies in different fields.	K2
CO4	Evaluate the applications of biotechnology in health care, environmental cleanup	K3
CO5	Evaluate the regional, global and international issues related with transgenic products	K3

K1 - Knowledge

K2 - Understand

K3 - Apply

### Mapping of COs with POs

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

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

### Mapping of COs with PSOs

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

## 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: Elements of Biotechnology

### Unit I

Introduction and history of Biotechnology. Conventional and Modern Biotechnology- Biotechnology industries- Transgenic and the environment- Prof. Paul Berg letter and Asilomer conference- Biotechnology and biosafety- Indian Biotech industry- DBT-Special programmes and schemes for societal development in India.

### Unit II

Biotechnology in India- DBT-Govt. of India- Research and Development-BIRAC-Special and Mission programmes for Traditional, Industrial and Societal Development-GEAC-BTRAI-ICGEB-CDFD- ICRISAT and other Indian-International organizations and their contributions. Biotechnology and its impact on Indian Agriculture.(with special reference to current Indian and International scenario).

### Unit III

Strategies of gene cloning. Tools used in gene cloning – Restriction endonucleases- DNA polymerase-DNA ligase-Cloning vectors-types and choice of vectors. Introduction of foreign genes and process of recombination– selection of recombinants.

### Unit IV

Molecular marker and finger printing techniques- PCR, RFLP, RAPD and blotting techniques. Application of biotechnology in health care and environmental cleanup.

### Unit V

Scope and applications of Biotechnology with special reference to regional, national and global needs. MANSANTO, MAHYCO and other issues related with transgenic products. Bt cotton and other genetically modified products and issues-national and international. Important discoveries and contributors in the field of Biotechnology -an overview.

### REFERENCES:

1. Principles of Gene Manipulation. Old & Primrose, (1989), 3rd edition.
2. Handbook on Biotechnology- Law, Business and Policy. Micheal Malinowski. 2016. West Academic Publishers. 1<sup>st</sup> edition.
3. Contemporary Biotechnology Bioengineering. He Xiaoxian.2014.Alpha Biotech. HP. Academic Press.

4. Biotechnology, Satyanarayana. U, (2008), Books and Allied (p) Ltd .
5. Biotechnology and Genomics, Gupta P.K: (2004) Rastogi publication.
6. Gene cloning and DNA analysis Brown, T.A (1996),. Blackwell Science, Osney Mead, Oxford.
7. A text book of Biotechnology, Dubey, R. C. (2007), S.Chand & Company Ltd. New Delhi. 6. Biotechnology, Singh, B. D (2004). Kalyani Publishers, New Delhi Note: This paper is offered for other major students.

Web Resources:

1. [https://uwyo.libguides.com/biotechnology\\_basics](https://uwyo.libguides.com/biotechnology_basics).
2. <http://dbtindia.gov.in/schemes-programmes/research-development/medical-biotechnology/biomedical-engineering-and-biodesign>.
3. <http://dbtindia.gov.in/schemes-programmes/research-development/agriculture-animal-allied-sciences/agriculture-biotechnology>.
4. <http://dbtindia.gov.in/schemes-programmes/biotechnology-programme-societal-development>.
5. <http://dbtindia.gov.in/schemes-programmes/mission-programmes/biopharma-mission>.
6. <http://dbtindia.gov.in/schemes-programmes/mission-programmes/biotech-krisi-innovation-science-application-network-biotech>

**Course Designer:**

Dr. K. Thangavel

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

**Programme Code-UBT**

Course code	Course Title	Category	L	T	P	Credit
UBT20GE11	Bioinstrumentation	Generic Elective	4	-	-	4

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

**Preamble**

To enable the students to understand the principles and working mechanisms of most common laboratory instruments used in biochemistry.

**Course Outcomes**

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

#	Course Outcome	Knowledge Level
CO1	Analyse the importance of biochemistry in biotechnology	K2
CO2	Demonstrate the principles and applications of basic instruments used in biochemical analysis.	K3
CO3	Understand the principle behind the methods used in detection of biomolecules	K3
CO4	Gain basic information about the role of radioisotopes in analytical biochemistry.	K1
CO5	Theoretical and practical knowledge about the extraction and purification of biomolecules	K3

K1 - Knowledge

K2 - Understand

K3 - Apply

**Mapping of COs with POs**

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

### Unit I:

Microscopy: Principles, instrumentation and applications of simple, compound and electron microscopes. pH metry: Principles, Operation method and uses. Buffer solutions for biological investigations. Colorimetry: principles, instrumentation and applications. Spectroscopic techniques: General principles-UV-visible spectrophotometer- principles, instrumentation and applications.

### Unit II:

Chromatography: Principles and applications of paper chromatography, thin layer chromatography, adsorption chromatography, ion exchange chromatography, molecular sieve chromatography, affinity chromatography, gas chromatography and high performance liquid chromatography (HPLC).

### Unit III:

Centrifugation techniques: Basic principles and sedimentation coefficient – Types of centrifuges and centrifugation: different types: differential centrifugation, density gradient centrifugation, - applications of centrifuge.

### Unit IV:

Radio isotope techniques: The nature of radioactivity – Detection and measurement of radioactivity -- Liquid Scintillation counting – Geiger-Muller counting of radioactivity – Autoradiography Applications of radioisotopes in Biological sciences.

### Unit V:

Extraction of DNA, RNA and Protein – principle – method. Purification of DNA, RNA and Protein – principle – method. Electrophoresis: Principles–Types: Paper electrophoresis, Agarose Gel Electrophoresis (AGE) Polyacrylamide gel electrophoresis (PAGE) and Capillary electrophoresis (CE). Applications of electrophoresis.

### Text Books:

1. Plummer, D. 1988. An introduction to Practical Biochemistry, Tata McGraw – Hill Publishing Company Ltd., New Delhi.

2. Rodney Boyer, 2000. Modern Experimental Biochemistry, 3rd Edition. Published by Addison Wesley Longman. Singapore.
3. Palanivelu, P. 2004. Laboratory Manual for analytical biochemistry and separation techniques, School of Biotechnology, Madurai Kamaraj university, Madurai.

**Reference Books:**

1. Wilson, K and J. Walker. 2005. Principles and Techniques of Practical Biochemistry, 5th Edition. Cambridge University press, New York.
2. Williams, B. L. and K. Wilson. 1983. A Biologist's guide to Principles and Techniques of Practical Biochemistry, Edward Arnold Publishers Ltd., London

**Web Resources:**

1. [https://uwo.libguides.com/biological techniques](https://uwo.libguides.com/biological_techniques).

**Course Designer:** G. Ramya Vaideki

**THIAGARAJAR COLLEGE, MADURAI – 9.**  
**(Re-Accredited with ‘A’ Grade by NAAC)**  
**Department of Biotechnology**  
 (For those joined B.A., B.Sc., B.Com., B.B.A., B.C.A on or after June 2020)  
**ENVIRONMENTAL STUDIES**

Course Code	Course Title	Category	L	T	P	Credit
U20ES11	Environmental Studies	AECC1	2	-	-	2

Year	Semester	Int. Marks	Ext.Marks	Total
First	First	15	35	50

### Preamble

Students acquire knowledge on the basic concepts, components and importance of environment.

### Course Outcomes

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

	Course outcomes	Knowledge Level
CO1	Define the structure and functions of ecosystem	K1
CO2	Explain the benefits of biodiversity conservation	K2
CO3	Summarise the sources, effects and control measures of various types of Pollutant and pollutants	K1
CO4	Perceive the environment legislations in India for sustainable development.	K3
CO5	Elaborate the impact of environmental problems on life systems	K3

**K1: Knowledge K2: Understand K3: Apply**

### Mapping of Course Outcomes with Programme Specific Outcomes

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

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

### Mapping of Course Outcomes with Programme Outcomes

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

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

## Blooms taxonomy: Assessment Pattern

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

## Course Title: Environmental Studies

### Unit I

Definition and Scope of Environmental Studies – Ecology and Ecosystem – Structure of an Ecosystem – Food chains, food webs and ecological pyramids – Causes of Biodiversity Loss – Benefit and Conservation of Biodiversity

### Unit II

Environmental problems and Management: Causes, effects and Control measures of : Air Pollution – Water Pollution – Noise pollution – Nuclear Hazards. Solid waste management and Waste Disposal methods. Climate change and Global Warming causes and Measures. Waste and Plastics. Urban environmental problems and measures. Environmental Legislations in India. Sustainable development and Inclusive growth.

### Text Book

2. Kanagasabai, C.S. 2005. Environmental Studies. Rasee publishers. Madurai.

### Reference Books

3. Yogendra, N. and Srivastava, N. 1998. Environmental Pollution, Ashish Publishing House. New Delhi.  
Sapru R.K. 2001. Environment Management in India, Vol. I & Vol. II Ashish publishers house, New Delhi.

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

Course Code	Course Title	Category	L	T	P	Credit
UBT20GL21	Bioinstrumentation & Biomolecules Lab	Generic Elective lab 1	-	-	2	2

Year	Semester	Internal Marks	External Marks	Total Marks
I	I	40	60	100

### Preamble

To understand the practice of protein purification, chromatography, electrophoresis, centrifugation, mass spectrometry, and other essential methods in modern molecular bioscience

### Course Outcomes

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

#	Course Outcome	Knowledge Level
CO1	Acquire knowledge on the preparation of buffers	K1
CO2	Isolate and quantify nucleic acids	K2
CO3	Isolate and quantify proteins	K2
CO4	Demonstrate electrophoresis	K3
CO5	Demonstrate dialysis	K3

K1-Knowledge

K2-Understand

K3-Apply

### Mapping of COs with POs

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

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

### Mapping of COs with PSOs

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

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

1. Determination of pH in various samples
2. Buffer preparation (verification of Handerson - Hasselbalchequation)
3. Separation of amino acids by paperchromatography
4. Separation of leaf pigments by Columnchromatography
5. Separation of sugars by TLC
6. Demonstration of SDSPAGE
7. Demonstration of Agarose gelelectrophoresis
8. Electrophoresis of RNA
9. Demonstration of dialysis

**CourseDesigner: G. RamyaVaideki**

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

Course Code	Course Title	Category	L	T	P	Credit
UBT20C21	Cytology and Cytogenetics	Core	5	-	-	5

L - Lecture                      T - Tutorial                      P - Practicals

Year	Semester	Int. Marks	Ext. Marks	Total
I	II	25	75	100

### Preamble

To afford the students with basic knowledge on types, cell cycle, cellular organelles, chromosome organization, cytogenetics, carcinogenesis and gene mutations.

### Course Outcomes

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

#	Course Outcome	Knowledge Level
CO1	Reveal the structural organization of prokaryotic and eukaryotic cells	K1
CO2	Demonstrate the levels of organization, chemical composition and functional significance of cell organelles	K2
CO3	Analyze the pattern of cell cycles in somatic and reproductive cells, its significance in growth and development.	K2
CO4	Illustrate the organization of chromosomes, transposable elements and their impact on heredity	K3
CO5	Evaluate the structural and numerical changes in chromosomes, causes and effects of genetic mutations and carcinogenesis.	K3

K1 - Knowledge

K2 - Understand

K3 - Apply

### Mapping of COs with POs

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

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

## Mapping of COs with PSOs

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

## 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: Cytology and Cytogenetics

**Unit I:** Cell theory- Cell as a basic unit of structure and function. Ultra structure and functions of prokaryotic, plant and animal cells. Cell wall- chemical composition and functions. Plasma membrane- structure and functions -fluid mosaic model.

**Unit II:** Cellular Organelle- Nucleus-structural organization. Chromosomes- heterochromatin and euchromatin. Ultrastructure and functions of Mitochondria, Chloroplast, endoplasmic reticulum, microsomes, golgi complex lysosomes and ribosomes. Non-living inclusions-different forms and their special functions.

**Unit III:** Cell cycle-stages-Mitosis-different stages. Mitogen, microtubules, centromere, kinetochore and cytokinesis, Cyclin dependent kinase, cohesion and condensin. Errors in cell division-endomitosis-abnormal chromosomes- lamp brush chromosomes and other abnormal forms.

### Unit IV:

Meiosis-stages of meiosis and its significance. Chromomere, lateral element, central element, transverse elements. Genetic recombination-models. Structural and Numerical changes in chromosomes-Aneuploidy and Euploidy. Monosomy, nullisomy, trisomy, tetrasomy,



## Unit V:

Cytogenetics and karyotyping - methods and applications in taxonomy, phylogenetics. Transposons- Introduction- pattern of expression and impact on heredity. Barbara McClintock's explorations. Gene mutations, oncogenes, oncoproteins and carcinogenesis. Important discoveries and contributors in the field of cytology and cytogenetics-an overview.

### Text Books:

1. Gerald Karp. 2002 Cell and Molecular Biology, John Wiley & Sons, New York
2. Geoffery. H. Cooper et al., 2004. Cell – Molecular approach, ASM press, Washington.
3. Gupta, P.K. 2004. Cell and Molecular Biology. Third Edition. Rastogi Publications.
4. Sharma, A.K and Sharma, A. 1999. Plant Chromosomes: Analysis, Manipulation and Engineering, Harwood Academic Publications, Australia.
5. Verma, P.S and Agarwal, V.K.2016. Cell Biology- Cytology, Bio molecules and Molecular Biology. S. Chand & Co, New Delhi.
6. Powar, C.B. 2009. Cell Biology. Himalayan Publishing House, New Delhi.
7. Sunil Kumar-Text Book of Cell Biology. 2010. S. Chand & Co, New Delhi.
8. Dnyansagar, V.R. 1987. Cell and Molecular Biology. Holt Saunders International, New York, USA.
9. Becker, W.M., Kleinsmith, L.J. and Hardin, J. 2007. The World of the cell, sixth edition, Pearson Education, Inc.

### References:

1. Alberts, B. et al., 1994. Molecular Biology of the Cell (3rd edition). Garland Publishing, Inc., New York
2. De Robertis E.D.P and E.M.F. De Robertis. 2011. Cell and Molecular Biology. (8<sup>th</sup> edition). B.I. Publications Pvt. Ltd., India.
3. De Robertis, E.D.P. and De Robertis, E.M.F. 2006. Essentials of Cell and Molecular Biology, Saunders College Publishing, Japan.

### Web Resources:

1. [https://uwo.libguides.com/cell\\_biology](https://uwo.libguides.com/cell_biology)
2. <https://cellbio.com/education>

### Course Designer:

1. Dr. K. Thangavel

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

Course Code	Course Title	Category	L	T	P	Credit
UBT20CL21	Cytology and Cytogenetics Practical	Core Lab-2	-	-	2	2

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

### Preamble

To provide the students with the basic practical knowledge on structure and function of cells, cellular organelles and chromosome organization.

### Course Outcomes

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

#	Course Outcome	Knowledge Level
CO1	Prepare microscopic slides, examine the structural organization and diversity of prokaryotic and eukaryotic cells.	K1
CO2	Distinguish different cell organelles and non living inclusions.	K2
CO3	Demonstrate transpiration and plasmolysis.	K2
CO4	Prepare smear, illustrate the stages of mitosis and meiosis and appraise their importance in growth and development.	K3

**K1- Knowledge K2 –Understand K3- Apply**

### Mapping of COs with POs

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

S-Strong M- Medium Low-Low

### Mapping of COs with PSOs

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

### Title of the paper: Cytology and Cytogenetics Practical

1. Observation of plant cells: onion peel, hydrilla leaf and stamina cells of Rheo.
2. Observation of animal cells: epithelial cells
3. Preparation of Root Tip squash and identification of stages in mitosis.
4. Preparation of smear of anther and identification in meiosis.
5. Blood smear preparation: observation of different cells

6. Determination of stomatal index
7. Determination of Osmotic potential of cell sap using plasmolysis method.
8. Study of Non living inclusions: Starch grain of potato tuber, rice and banana. Cystolith of Ficus raphide of Acalypha, Crystals of dry onion peel
9. Haemocytometer – Cell counting
10. Measurement of cell dimension by Micrometry.

### References

1. Harris, N. and K. J. Oparka. 1994. Plant Cell Biology- A practical approach. IRL Press, OUP, Oxford.
2. Dixon, R. A. and R. A. Gonzales. 1994. Plant Cell Culture. A Practical Approach. Oxford University Press, Oxford.
3. Krishnamoorthy, K. V. 1988. Methods in Plant Histochemistry. Viswanathan publishers, Chennai, India.

### Web Resources:

1. [https://uwoy.libguides.com/cell\\_biology\\_practical\\_manual](https://uwoy.libguides.com/cell_biology_practical_manual).

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

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

Course Code	Course Title	Category	L	T	P	Credit
UBT20C22	Microbial Genetics	Core-4	3	-	-	3

L – Lecture                      T – Tutorial                      P- Practicals

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

### Preamble

To familiarize the students, of the core principles , paradigms and unique aspects of microbial genetics and state –of- the –art research techniques used in microbial genetics .

### Course Outcomes

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

#	Course Outcome	Knowledge Level
CO1	Analyze the gene arrangements and organization of bacterial genome.	K1
CO2	Classify the plasmids; compare the various structural organizations of plasmids and other transposable elements.	K2
CO3	Understand the concepts of bacterial genetics.	K2
CO4	Learn the various concepts involved in the life cycle of bacteriophages.	K1
CO5	Categorize the mating types of fungi and appreciate their importance of fungal genetics..	K3

K1 - Knowledge

K2 - Understand

K3 - Apply

### 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      Microbial Genetics

### Unit: I

Physical organization of bacterial genomes – structure of bacterial nucleoid - solenoid model–

partitioning of the bacterial genome and genome of Arachae. Concept of gene – unit of gene - muton, recon and cistron – fine structure of gene- One gene one enzyme, one gene one polypeptide, one gene one product hypothesis – interrupted gene.

### Unit: II

Extrachromosomal and Mobilizable genetic elements : Plasmids – types- F plasmid – conjugative – non conjugative plasmids – mobilization of non conjugative plasmids- R plasmid – col plasmid – copy number – incompatibility – episomes. Transposable elements - IS elements – transposons . Integrons – antibiotic resistance cassettes – multiple antibiotic resistance bacteria – Mu virus.

### Unit: III

Bacterial genetics – mutant phenotype – transformation – Griffith's experiment – DNA as genetic material – conjugation – co-integrate formation – Hfr cells –Impact of gene transfer on

microbial evolution - basis for classical mapping.

### Unit: IV

Phage Genetics- Bacteriophages – lytic life cycle –stages – T7 ,lysogenic life cycle – E.coli phages – phi X 174, phage mutants – genetic recombination in the lytic cycle .Bacteriophage typing, application in bacterial genetics.

### Unit: V

Fungal Genetics- Features and consequences of heterothallism, homothallism, mating types, Vegetative incompatibility, Polyploidy and aneuploidy. Neurospora- Tetrad analysis and

linkage detection - 2 point and 3 point crosses – Mitotic recombination in Neurospora.

### Text Books:

1. Uldis N. Strepis and Ronald E. Yasbin(Ed).2002.Modern microbial genetics. Second edition.Wiely-Liss,Inc.
2. Bainbridge,B.W.1987.Basic principles of microbial genetics .In: Genetics of microbes.Tertiary level biology. Springer,Boston,MA.

**Reference Books:**

1. David friefelder.1990. Microbial genetics, Part 8, Jones and Barlett series in Biology., Narosa publishing house.
2. Stanley R. Maloy, John E.Cronan and David Friefelder.1994. Second edition.Microbial genetics. Jones and Barlett publishers.

**Web Sources:**

1. <https://www.mdpi.com/journal/genes/sections/MGG>
- 2.[https://books.google.co.in/books/about/Microbial\\_genetics.html?id=vr5qAAAAMAAJ&redir\\_esc=y](https://books.google.co.in/books/about/Microbial_genetics.html?id=vr5qAAAAMAAJ&redir_esc=y)
- 3 .<https://www.ncbi.nlm.nih.gov/genome/microbes/>

**Course designers:**

1. S.Yogachitra, S.Siva Durga

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

Course Code	Course Title	Category	L	T	P	Credit
UBT20GE21	BIO MOLECULES	GE2	4	-	-	4

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

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

### Preamble

To familiarize the students, the molecular architecture of Biomolecules and compare the various structural organization of Biomolecules.

### Course Outcomes

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

#	Course Outcome	Knowledge Level
CO1	Analyze the molecular architecture of carbohydrates.	K1
CO2	Classify the aminoacids; compare the various structural organizations of proteins.	K2
CO3	Elaborate the structure and function of nucleic acids.	K2
CO4	Learn the various concepts involved in the mechanism of enzyme action.	K1
CO5	Categorize the lipids, appreciate their importance	K3

K1 - Knowledge                      K2 - Understand                      K3 - Apply

### 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

## 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 BIO MOLECULES

### Unit: I

Carbohydrates: Structure and function of Monosaccharides (Glucose, fructose) – Disaccharides (Sucrose, lactose) – Cell wall polysaccharides (Cellulose, peptidoglycan) – storage polysaccharides (Starch, glycogen) General account on chitin, pectin and lignin.

### Unit: II

Aminoacids: General properties – Classification – based on polarity – protein and non-protein aminoacids. Proteins – Structure, properties and functions of Protein. Primary structure, Secondary structure, tertiary and quarternary structure

### Unit: III

Enzymes: Classification and nomenclature — Mechanism of enzyme action – Factors affecting enzyme action - enzyme inhibition – Michaelis Menten constant-Theories on enzyme action.

### Unit: IV

Structure and functions of Nucleic acids: Nucleosides – Nucleotides – Purines and pyrimidines – phosphodiester bonds-histones – role of histones in DNA packaging. DNA double helix (Watson & Crick Model) – A, B, Z forms of DNA – RNA types: mRNA, tRNA, rRNA, small RNA and hnRNA.

### Unit: V

Lipids: Classification (outline) –Saturated and unsaturated fatty acids -Simple non-saponifiable lipids: terpenes, steroids, sterols – Cholesterol, Ergosterol - phosphotidylcholine – complex saponifiable lipids: triglycerides, phosphoglycerides - membrane lipids – lipoprotein complex.

### Text Books:

1. Zubay, G. 1998. Biochemistry, Fourth edition. Won C. Brown publishers, London.
2. Conn. E. E., P. K. Stumpf, G. Bruening and R.H. Doi, 2009.Fifth edition. Outlines of Biochemistry, John Wiley & sons Inc., New York.
3. Trudy McKee and J.R. McKee. 2012. Seventh edition. Biochemistry - The molecular basis of life . Won C. Brown publishers, London.
4. S.R. Mishra. 2003. Biomolecules. Discovery publishing house.New Delhi

### Reference Books:

1. Berg, Jeremy M, John L. Tymoczko, Lubert Stryer and Lubert Stryer. 2002. Biochemistry, Seventh edition .W.H. Freeman and company, New York.
2. Voet, D. and J. G. Voet, 1995. Biochemistry, Seventh edition. John Wiley & Sons Inc, New York.



3. Nelson, D. L. and M. M. Cox, 2017. Seventh edition Lehninger Principles of Biochemistry, W H Freeman publishers, New York.

**Web Source:**

1. [http://med.fau.edu/students/md\\_m1\\_orientation/Overview.pdf](http://med.fau.edu/students/md_m1_orientation/Overview.pdf)
2. <https://www.sciencedirect.com/topics/engineering/biomolecule>
3. <https://www.mdpi.com/journal/biomolecules>

**Course designer**

1. S.Yogachitra

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

Course Code	Course Title	Category	L	T	P	Credit
UBT20GEL21	Bioinstrumentation & Biomolecules Lab	Allied Lab 2	-	-	2	-

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

### Preamble

Acquire knowledge on quantitative estimation of various Biomolecules. Have hands on training on colorimetric and spectrophotometric analysis and titre metric procedures .

### Course Outcomes

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

#	Course Outcome	Knowledge Level
CO1	Acquire knowledge on the measurement of pHi of aminoacids	K1
CO2	Acquire knowledge on quantitative estimations of biomolecules	K1
CO3	Apply the knowledge of colorimetric analysis	K3
CO4	Make use of the titration for the saponification of fats. .	K3
CO5	Experiment with the Enzyme kinetics	K3

K1 - Knowledge

K2 - Understand

K3 – Apply

### 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	M	S	L	M	M
CO2	S	M	S	L	M
CO3	S	L	M	S	M
CO4	S	S	M	L	M
CO5	S	L	L	M	L

S (+++) – Strong

M (++) - Medium

L (+) - Low

**Title of the paper BIOMOLECULES LAB**

1. Measurement of pHi of aminoacid
2. Quantitative estimation of soluble sugars by phenol sulphuric acid method
3. Quantitative Estimation of Protein by Lowry's Method
4. Quantitative estimation of DNA by Diphenylamine method.
5. Quantitative estimation of RNA by Orcinol method.
6. Quantitative estimation of glucose by anthrone method.
7. Quantitative estimation of glycogen
8. Quantitative estimation of total amino acids – ninhydrin method.
9. Saponification of fats –titration method.
10. Effect of Substrate concentration, pH and Temperature on Amylase enzyme activity

**Course contents and lecture schedule**

	<b>Topic</b>	<b>lecture hrs.</b>	<b>Method of teaching</b>
1	Measurement of pHi of aminoacid	2	Hands on Training.
2	Quantitative estimation of soluble sugars by phenol sulphuric acid method	3	Hands on Training.
3	Quantitative Estimation of Protein by Lowry's Method	3	Hands on Training
4	Quantitative estimation of DNA by Diphenylamine method	3	Hands on Training.
5	Quantitative estimation of RNA by Orcinol method	4	Hands on Training.
6	Quantitative estimation of glucose by anthrone method.	3	Hands on Training.
7	Quantitative estimation of glycogen	3	Hands on Training.
8	Quantitative estimation of total amino acids – ninhydrin method.	2	Hands on Training.
9	Saponification of fats –titration method.	3	Hands on Training.
10	Effect of Substrate concentration, pH and Temperature on Amylase enzyme activity	4	Demonstration
Total Hours		30	

**Text Books:**

1. Rajagopal.G. Toora.B.D. 2005. Practical Biochemistry. .Ahuja Publishing House, New Delhi.
2. Shawney.S.H.1999.Introductory Practical Biochemistry.Narosa publishing House, New Delhi.
3. Damodaran Geetha.K. 2016. Practical Biochemistry. Second edition. Jaypee Brothers, India.
4. David. T. Plummer.2006. An Introduction To Practical Biochemistry. Tata Mc Graw Hill Education.

**Reference books:**

1. Andreas Hofmann and Samuel Clokie.2018. Wilson and Walker's Principles and Techniques Of Biochemistry and Molecular Biology. Eighth Edition. Cambridge University Press, USA.

**Web sources:**

- [https://www.researchgate.net/publication/332028407\\_Biochemistry\\_A\\_Practical\\_Manual](https://www.researchgate.net/publication/332028407_Biochemistry_A_Practical_Manual)

[https://www.researchgate.net/publication/301647645\\_PRACTICAL\\_BIOCHEMISTRY](https://www.researchgate.net/publication/301647645_PRACTICAL_BIOCHEMISTRY)

**THIAGARAJAR COLLEGE, MADURAI – 9.**  
**(Re-Accredited with ‘A’ Grade by NAAC)**  
**Department of Biotechnology**  
 (For those joined B.A., B.Sc., B.Com., B.B.A., B.C.A on or after June 2020)  
**VALUE EDUCATION**

Course Code	Course Title	Category	L	T	P	Credit
U20VE21	Value Education	AECC2	2	-	-	1

Year	Semester	Int. Marks	Ext.Marks	Total
First	Second	15	35	50

### Preamble

Students acquire knowledge on the basic concepts, components and importance of environment.

### Course Outcomes

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

	Course outcomes	Knowledge Level
CO1	Define the values, Self assessment and values needed for self development	K1
CO2	Explain about the good character and good relationships	K2
CO3	Summarise the types of thoughts, developing thought pattern, external influences on thoughts	K1
CO4	Find out the causes of Illusions, Symptoms and stages of stress	K3

K1: Knowledge K2: Understand K3: Apply

### Mapping of Course Outcomes with Programme Specific Outcomes

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

### Mapping of Course Outcome with Programme Outcomes

	PSO1	PSO2	PSO3	PSO4	PSO5	PO6
CO1	L	-	M	-	-	-
CO2	-	L	M	L	-	L
CO3	M-	M	S	-	-	-
CO4		-	M	L	-	M

## Blooms taxonomy: Assessment Pattern

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

## Course Title: Value Education

### Unit I

**Self Development** – Introduction - Definition and Types of Values – Self Assessment – Values needed for self development - Values needed for family life –Principles of happy living

**Character development**- Good character – Good relationships - Legendary people of highest character – The quest for character –Developing character -The key to good character.

### Unit II:

**Positive Thinking and Self Esteem** - Types of thoughts - Areas of thinking - Developing thought pattern - External influences on Thoughts - Methods to keep outlook positive – Meaning of Self Esteem – Self empowerment.

**Stress free living** – Illusions and causes - Symptoms and stages of stress – Self confidence– Role models and leadership qualities – Critical thinking - Communication skills – Happy and successful life.

### Reference:

#### Study material / Course material

1. Values for Excellence in Life Compiled by then Curriculum Development Cell Thiagarajar College, Madurai, in collaboration with the Education wing, Brahma Kumaris, Madurai.