Thiagarajar College

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

Thirty Eighth Academic Council Meeting

Department of Botany

Dr. Rm. Murugappan
Dean – Curriculum Development

B.Sc. Botany

Programme Code : UBO

THIAGARAJAR COLLEGE, MADURAI – 9.

(Re-Accredited with 'A' Grade by NAAC)

Curriculum structure for

B.Sc., CS, IT & BCA BBA & B.Com

(For those who joined in 2019 and after)

Catergory	Course	No.of Courses /paper	Credit Distribution	Hrs/ Week	Total Credits
Part I	Tamil	2	3	-	06
Part II	English	2	3	-	06
		Sub Total			**12**
Part III	Core	-	-	-	84
	Elective –Main	2	5	-	10
	Elective – Generic	2+2	5	-	20
		Sub Total			**114**
Part IV	**AECC** I &II Sem	I sem EVS II Sem .Prof.Skill Development	2	4	04
	NME III & V Sem Horizontal Migration **SEC** IV & VI Sem Vertical Migration	2 2	2	8	08
	Value Education V Sem	1	1	2	**01**
		Sub Total		**14**	**13**
	Total				**139**
Part V	**NCC (Army &Navy)/ PE/ NSS / Rotaract/ Quality Circle/ Library/ SSL/ Nature Club/Value Education/ YRC/WSC**				**01**
	Grand Total				**140**
	Self-Study Paper (Optional)- -V Sem			**05**	**145**

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 &V semester)
- For SEC every department offer three papers for each course (Sem IV & VI)
- For Major elective there may be an option for choice.

THIAGARAJAR COLLEGE, MADURAI – 9.

(Re-Accredited with ‘A’ Grade by NAAC)

Curriculum structure for

BA Tamil, English & Economics

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

(For those who joined in 2019 and after)

Catergory	**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
		Sub Total		**48**	**24**
Part III	Core			72 +12	72
	Elect –Main	2	5	10	10
	Elect – Generic	2+2	5	24	20
		Sub Total		**118**	**102**
Part IV	**AECC** I &II Sem	I sem EVS II Sem .Prof.Skill Development	2	4	04
	NME III & V Sem Horizontal Migration **SEC** IV & VI Sem Vertical Migration	2 2	2	8	08
	Value Education V Sem	1	1	2	**1**
		Sub Total		**14**	**13**
	Total				**139**
Part V	**NCC (Army &Navy)/ PE/ NSS / Rotaract/ Quality/WSC Circle/ Library/ SSL/ Nature Club/Value Education/ YRC**				**1**
	Grand Total				**140**
	Self-Study Paper (Optional)- -V Sem			**05**	**145**

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 &V semester)
- For SEC every department offer three papers for each course (Sem IV & VI)
- For Major elective there may be an option for choice.

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

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.

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 this Programme is to equip/prepare the students

PEO1	Graduates of the program will develop a strong and competent knowledge in basic Plant science required for critical learning and research.
PEO2	Graduates will develop diversified basic professional skills through various laboratory technical training, communication and presentation skills.
PEO3	Graduates will possess an ability to identify, formulate, and solve Plant problems to contribute to service efforts to community in both the professional and private realm
PEO4	Graduates will integrate related topics from separate parts of the course such as levels of plant organization, Techniques, cell biology, ecology, evolution, biochemistry, genetics, embryology, basic biotechnology, physiology, molecular biology, taxonomy, anatomy for successful career.
PEO5	Graduates will be proficient to assess the scope of plant science, appreciate the complexities of biological organization and address scientifically controversial issues in a rational way

Programme specific outcomes- B.Sc.,Botany

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

PO1	identify various plant life forms, using specific identification key characteristic features
PO2	demonstrate the acquired knowledge and 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
PO3	show their skills in practical work, experiments, use of biological tool and techniques
PO4	explore various life forms and their intricacies of at the cellular and molecular and Level.
PO5	expertise in statistical analyses of data for better interpretations and problem solving

THIAGARAJAR COLLEGE, MADURAI – 9.
(Re-Accredited with ‘A’ Grade by NAAC)
DEPARTMENT OF BOTANY
Bachelor of Science (B.Sc.,) Botany (w.e.f. 2019 batch onwards)
Programme Code-UBO
Programme Scheme
Semester – I

Course	Code No	Subject	Hrs/ Week	Cred.	Total Hrs	Max Marks CA	Max Marks SE	Total
Part I	U19TA11	Tamil	6	3	90	25	75	100
Part II	U19EN11	English	6	3	90	25	75	100
Core 1	UBO19C11	Plant Diversity I	6	6	90	25	75	100
Core Lab 1	UBO19CL11	Plant Diversity I Lab	4	2	60	40	60	100
Allied	UMB19GE11B	Zoology	4	4	60	25	75	100
Allied lab	UMB19GL21B	Zoology Lab	2	-	30			
AECC1	U19ES11	EVS	2	2	30	15	35	50
TOTAL			**30**	**20**				550

Semester – II

Course	Code No	Subject	Hrs/ Wee k	Cred	Total Hrs	Max Marks CA	Max Marks SE	Total
Part I	U19TA21	Tamil	6	3	90	25	75	100
Part II	U19EN21	English	6	3	90	25	75	100
Core 2	UBO19C21	Plant Diversity II	6	6	90	25	75	100
Core Lab 2	UBO19CL21	Plant Diversity II Lab	4	2	60	40	60	100
Allied	UMB19GE21B	Zoology	4	4	60	25	75	100
Allied Lab	UMB19GL21B	Zoology Lab	2	--	30			
Practical Examination for Allied Zoology				2		40	60	100
AECC2	UBO19AE21	Personality development	2	2	30	15	35	50
TOTAL			**30**	**22**				650

Semester – III

Course	Code No	Subject	Hrs/ Week	Cred	Total Hrs	Max Marks CA	Max Marks SE	Total
Part I	U19TA31	Tamil	6	3	90	25	75	100
Part II	U19EN31	English	6	3	90	25	75	100
Core 3	UBO19C31	Microbiology and Plant Pathology	3	4	45	25	75	100
Core 4	UBO19C32	Cell biology and Plant Anatomy	3	4	45	25	75	100
Core Lab 3	UBO19CL31	Microbiology, Plant Pathology, Cell biology and Plant Anatomy Lab	4	2	60	40	60	100
Allied	UCH19GE31B	General Chemistry - I	4	4	60	25	75	100
Allied Lab	UCH19GL41B	Chemistry Lab	2	--	30	-	-	-
NME	UBO19NE31	Gardening	2	2	30	15	35	50
TOTAL			**30**	**22**				650

Semester – IV

Course	Code No	Subject	Hrs/ Week	Cred	Total Hrs	Max marks CA	Max Marks SE	Total
Part I	U19TA41	Tamil	6	3	90	25	75	100
Part II	U19EN41	English	6	3	90	25	75	100
Core 5	UBO19C41	Plant embryology and Tissue Culture	3	4	45	25	75	100
Core 6	UBO19C42	Bioinstrumentation and Computer Applications	3	4	45	25	75	100
Core Lab 4	UBO19CL41	Plant embryology, Tissue Culture, Bioinstrumentation and Computer Applications Lab	4	2	60	40	60	100
Allied	UCH19GE41B	General Chemistry II	4	4	60	25	75	100
Allied Lab	UCH19GL41B	Chemistry Lab	2		30			
Practical Examination for Allied Zoology				2	40	40	60	100
SBE	UBO19SE41(A)/ UBO19SE41(B)/ UBO19SE41(C)	SEC(A) Histologyand Staining Techniques/ SEC(B) Biofertilizers and Organic farming/ SEC(C) Bioremediation	2	2	30	15	35	50
Total			**30**	**24**				**750**

Semester – V

Course	Code No	Subject	Hrs/ Week	Cred	Total Hrs	Max Marks CA	Max Marks SE	Total
Core7	UBO19C51	Morphology and Taxonomy of Angiosperms	4	4	60	25	75	100
Core 8	UBO19C52	Plant Biochemistry	4	4	60	25	75	100
Core 9	UBO19C53	Genetics, Evolution and Biostatistics	3	4	45	25	75	100
Core Lab 5	UBO19CL51	Morphology and Taxonomy of Angiosperms Lab	4	2	60	40	60	100
CoreLab6	UBO19CL52	Plant Biochemistry Lab	4	2	60	40	60	100
Core Lab 7	UBO19CL53	Genetics, Evolution and Biostatistics Lab	2	1	30	40	60	100
CoreElective1	UBO19CE51(H)/ UBO19CE51(P)	UBO19CE51(H) Horticulture and Plant Breeding/ UBO19CE51(P) Plant Resources and Utilisation	5	5	75	25	75	100
NME2	UBO19NE51	Botanical world	2	2	30	15	35	50
VE	U19VE51	Value Education	2	1	30	15	35	50
Total			**30**	25				800

Semester – VI

Course	Code No	Subject	Hrs/ Week	Cred.	Total Hrs	Max Mark CA	Max Marks SE	Total
Core 10	UBO19C61	Plant Physiology	4	4	60	25	75	100
Core 11	UBO19C62	Biotechnology	4	4	60	25	75	100
Core 12	UBO19C63	Ecology and Biodiversity	3	4	45	25	75	100
Core Lab 8	UBO19CL61	Plant Physiology Lab	4	2	60	40	60	100
Core Lab 9	UBO19CL62	Biotechnology Lab	4	2	60	40	60	100
Core Lab 10	UBO19CL63	Ecology and Biodiversity Lab	4	2	60	40	60	100
Core Elective2	UBO19CE61(B)/ UBO19CE61(N)	EMB61(B) Basics of Molecular Biology/ EMB61(N) Nutraceuticals	5	6	75	25	75	100
SBE	UBO19SE61(D)/ UBO19SE61(E)/ UBO19SE61(F)	UBO19SE41(D)Mushroom Technology/ UBO19SE41(E) Seed and Nursery Technology/ UBO19SE41(F)Food Processing Technology	2	2	30	15	35	50

TOTAL			**30**	26				750
TOTAL CREDITS FOR SEMESTERS I to VI				**139**	**(20+22+22+24+25+26)**			

A) Consolidation of contact hours and credits: UG

Semester	Contact Hrs/ Week	Credits
I	30 hrs	20
II	30 hrs	22
III	30 hrs	22
IV	30 hrs	24
V	30 hrs	25
VI	30 hrs	26
Part - V	-	01
Total	180 hrs	140

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**	**12**	**4/6**	**52**
	Core lab	**10**	**1/2**	**19**
	Core Elective	**2**	**5/6**	**11**
	Generic Elective Theory	**4**	**4**	**16**
	Generic Elective Theory	**2**	**2**	**4**
Part IV	**AECC**	**2**	**2**	**4**
	NME	**2**	**2**	**4**
	SEC	**2**	**2**	**4**
	VE	**1**	**1**	**1**
Part V (NSSNCC/Physical Education)				**1**
Grand total				**140**

Thiagarajar College (Autonomous): Madurai – 625 009

Department of Botany

(For those joined B. Sc., Botany on or after June 2019)

Programme Code-UBO

Course Code	Course Title	Category	L	T	P	Credit
UBO19C11	**Plant Diversity I**	**Core- 1**	**6**	**-**	**-**	**6**

Year	Semester	Int. Marks	Ext.Marks	Total
First	First	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 (according to Bloom's Taxonomy)
CO1	Recognize the lower group of plants	K1
CO2	Elucidate the diversity and complexity of life forms	K2
CO3	Distinguish the life forms based on their morphology and anatomy	K2
CO4	Realize the significance of lower group of plants	K2
CO5	Discover commercially important phytochemcials in lower groups	K3

K1 - Knowledge K2 - Understand K3 - Apply

Mapping of Course Outcomes with Programme Specific Outcomes

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

S-Stong M-Medium L-Low

Blooms taxonomy: Assessment Pattern

	CA		End of Semester
	First	Second	
Knowledge	40%	40%	40%
Understand	40%	40%	40%
Apply	20%	20%	20%
Total	52	52	140

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

Unit I: Classification of Algae based on Fritsch system. General characters of Blue-green algae and Green algae. Occurrence, structure, heterocyst and its function, reproduction and life cycle of *Nostoc*. Occurrence,external and internal structure, reproduction and life cycle of*Caulerpa* and *Oedogonium.*

Unit II: General characters of Brown algae and Red algae. External and internal structure, reproduction and life cycle of*Padina, Sargassum*and*Gracilaria*. Economic importance of Algae.

Unit III: Classification of Fungi based on Alexopoulos system. General characters of Oomycetes, Zygomycetes, Ascomycetes and Basidiomycetes. Structure, reproduction and life cycle of *Saprolegnia, Rhizopus,Aspergillus*and*Agaricus.*

Unit IV: 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 V: General classification of Bryophytes based on Rothmoler. Occurrence, External and Internal structure of Gametophyte, Sporophyte, Reproduction andLife cycle of*Marchantia*and*Polytrichum*.

Text Books:

1. Vashishta, B.R. ,Sinha, A.K.. and Singh, V.P. 2005. Botany for Degree Students- Algae, S.Chand&Company Ltd., New Delhi.
2. Vashishta, B.R. and Sinha,A.K. 2010. Botany for Degree Students- Fungi, S.Chand&Company Ltd., New Delhi.
3. Vashishta, B.R., Sinha,A.K. and Adarsh Kumar. 2005. Botany for Degree Students- Bryophyta, S.Chand&Company Ltd., New Delhi.

Reference Books:

1. West, G.S. 2010. Algae Vol. I. Myxophyceae, Peridinieae, Bacillariaceae, Chlorophyceae, Cambridge Botanical hand book series, UK.
2. Tuba, Z., N.G., Sleck and L.R. Stark. 2011. Bryophyte, Cambridge University Press, UK.
3. Dube, H.C. 2009. Introduction to Fungi, Vikas publishing Pvt. Ltd., New Delhi.
4. Paracer, S and V.Ahmadjian. 2002. Symbiosis, Oxford University Press, Chennai.

Course designer

1. **Dr. K.Saraswathi**

Lecture Schedule

	Topic	No of lecture hrs.	Method
1.1	Algae classification - Fritsch system	4	Black Board
1.2	General characters of BGA	1	Black Board
1.3	*Nostoc* –Occurrence, structure, heterocyst, reproduction and life cycle	3	Black Board and Practical Observation
1.4	General characters of Green algae	1	Black Board
1.5	*Caulerpa* - Occurrence, structure, reproduction and life cycle	3	Black Board and Practical Observation
1.6	*Oedogonium* - Occurrence, structure, reproduction and life cycle	3	Black Board and Practical Observation
2.1	General characters of Brown algae	1	Black Board
2.2	*Padina*- Occurrence, structure, reproduction and life cycle	3	Black Board and Practical Observation
2.3	*Sargassum* - Occurrence, structure, reproduction	3	Black Board
2.4	General characters of Red algae	1	Black Board
2.5	*Gracilaria* - Occurrence, structure, reproduction and life cycle	3	Black Board and Practical Observation
2.6	Economic importance of algae	4	PPT
3.1	Fungi classification – Alexopoulos system	5	Black Board
3.2	General characters of Oomycetes	1	Black Board
3.3	*Saprolegnia*- Occurrence, structure, reproduction and life cycle	3	Black Board
3.4	General characters of Zygomycetes	1	Black Board
3.5	*Rhizopus* - Occurrence, structure, reproduction	3	Black Board
3.6	General characters of Ascomycetes	1	Black Board
3.7	*Aspergillus* - Occurrence, structure, reproduction	4	Black Board
3.8	General characters of Basidiomycetes	1	Black Board
3.9	*Agaricus* - Occurrence, structure, reproduction	4	Black Board and Practical Observation
4.1	General characters of Deuteromycetes	1	Black Board
4.2	*Fusarium* - Occurrence, structure and reproduction	3	Black Board
4.3	Economic importance of fungi	5	PPT
4.4	Lichen- Morphology and Types	3	Black Board
4.5	Lichen- Components, symbiosis and pollution indicators	3	Black Board
4.6	Lichen- Reproduction and Apothecium	3	Black Board
4.7	Lichen- Economic importance	4	PPT
5.1	Bryophytes classification- Rothmaler	3	Black Board
5.2	*Marchantia*- gametophyte structure, reproduction	4	Black Board
5.3	*Marchantia*- sporophyte	2	Black Board
5.4	*Polytrichum* – gametophyte structure, reproduction	4	Black Board
5.5	*Polytrichum* – sporophyte	2	Black Board
	TOTAL	90	

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Department of Botany
(For those joined B. Sc., Botany on or after June 2019)
Programme Code-UBO

Course Code	Course Title	Category	L	T	P	Credit
UBO19CL11	**Plant Diversity I Lab**	**Core Lab-1**		**-**	**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 Plant Diversity I lab course the student will be able to

#	Course Outcome	Knowledge Level (according to Bloom's Taxonomy)
CO1	Identify algae and fungi based on their morphology	K1
CO2	Distinguish the life forms at generic level based on anatomical variations	K2
CO3	Recognize the morphological variations of lichens	K1,K2
CO4	Equipped with micro preparation of fungal species from various samples	K3

K1 - Knowledge K2 - Understand K3 – Apply

Mapping of Course Outcomes with Programme Specific Outcomes

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

S-Strong M-Medium L-Low

Plant Diversity I Practicals

1. Cyanophyceae- Identification of *Nostoc* from fresh water samples and Study of filament structure.
2. Chlorophyceae- Study of Morphological and anatomical features of *Caulerpa*
3. Chlorophyceae- Study of *Oedogonium* filament and reproductive cells using permanent slides
4. Phaeophyceae- *Padina* - Study of Morphology and anatomy of macroscopic gametophyticthallus, gametangium and tetrosporophyticthallus.
5. Phaeophyceae- *Sargassum* -Morphology and anatomy of macroscopic thallus
6. Rhodophyceae – *Gracilaria*- gametophyte, sporophyte and cystocarp
7. Oomycetes- Study of *Saprolegnia*reproductive structure using permanent slides
8. Zygomycetes- Micropreparation and Study of *Rhizopus*sporangiophore
9. Ascomycetes- Micropreparation and Study of *Aspergillus*conidiophore
10. Basidiomycetes- Study of Morphological and anatomical features of*Agaricus*.
11. Deuteromycetes- Micropreparation and study of, *Fusarium* conidia.
12. Foliose and Fruticose Lichens- Study of Morphology of *Parmelia*and*Usnea*; L.S. of Lichen Apothecium.
13. Hepaticopsida-Study of external and internal structure of *Marchantia*thallus.
14. Bryopsida- Study of external and internal structure of *Polytrichum gametophyte*. L.S. of Capsule

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Programme Code-UBO

Course Code	Course Title	Category	L	T	P	Credit
UBO19C21	**Plant Diversity II**	**Core-2**	**6**	**-**	**-**	**6**

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

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 (according to Bloom's Taxonomy)
CO1	Identify the first land plants and flowering plants	K1
CO2	Distinguish the living and fossil forms	K2
CO3	Describe their diversity and complexity	K2
CO4	Realize their ecological and economic benefits	K2
CO5	Analyse the reasons for fossilization	K3

K1 - Knowledge K2 - Understand K3 – Apply

Mapping of Course Outcomes with Programme Specific Outcomes

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

S-Stong M-Medium L-Low

Blooms taxonomy: Assessment Pattern

	CA		End of Semester
	First	Second	
Knowledge	40%	40%	40%
Understand	40%	40%	40%
Apply	20%	20%	20%
Total	52	52	140

Unit I: General characteristic features of Pteridophytes. SmithClassification of Pteridophytes. General characteristic features of Psilopsida. *Psilotum* – habitat, distribution, external structure, internal structure and reproduction. General characteristic features of Lycopsida. *Lycopodium* - external structure, internal structure, reproduction and stele types. *Selaginella*- external structure, internal structure, reproduction, heterospory and seed habit.

Unit II: General characteristic features of Sphenopsida. *Equisetum* – habitat, distribution, external structure, internal structure and reproduction. General characteristic features of Pteropsida. *Pteridium* - habitat, distribution, external structure, internal structure and reproduction. *Marsilea* - Habitat, distribution, external structure, internal structure and reproduction. Economic importance of Pteridophytes.

Unit III: General characteristic featuresGymnosperms.Classification of GymnospermsbySporne. 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: Palaeobotany - Geological time scale - brief account on process of fossilization - Fossil types. Structure and reproduction 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

Lecture Schedule

	Topic	No of lecture hrs.	Method
1.1	General characters of Pteridophytes	3	Black Board
1.2	Classification of Pteridophytes – Smith	3	Black Board
1.3	General characters of Psilopsida	1	Black Board
1.4	*Psilotum* – Habit, structure, reproduction and life cycle	3	Black Board
1.5	General characters of Lycopsida	2	Black Board
1.6	*Lycopodium*- Habit, structure, reproduction and life cycle	4	Black Board and Practical Observation
1.7	Stele types in Lycopodium	3	Black Board and Practical Observation
1.8	*Selaginella* - Habit, structure, reproduction and life cycle	4	Black Board and Practical
1.9	*Selaginella* – Heterospory and seed habit	3	PPT
2.1	General characters of Sphenopsida	2	Black Board
2.2	*Equisetum* - Habit, structure, reproduction and life cycle	3	Black Board and Practical Observation
2.3	General characters of Pteropsida	2	Black Board
2.4	*Pteridium* - Habit, structure, reproduction and life cycle	4	Black Board and Practical
2.5	*Marsilea*- Habit, structure, reproduction and life cycle	4	Black Board and Practical
2.6	Economic importance of Pteridophytes	4	PPT
3.1	General characteristic featuresGymnosperms	3	Black Board
3.2	Classification of Gymnosperms	4	Black Board
3.3	General characters of Cycadopsida	2	Black Board
3.4	*Cycas*- Habit, structure, reproduction and life cycle	3	Black Board
3.5	General characters of Coniferopsida	2	Black Board
3.6	*Pinus* - Habit, structure, reproduction and life cycle	4	Black Board and Practical Observation
4.1	General characters of Gnetopsida	2	Black Board
4.2	*Gnetum* - Habit, structure, reproduction and life cycle	4	Black Board
4.3	Economic importance of Gymnosperms	6	PPT
5.1	Paleobotany – Introduction	1	PPT
5.2	Geological time scale	4	PPT
5.3	Fossilization process	2	Black Board
5.4	Fossil types	2	Black Board
5.5	*Rhynia* –Structure and Reproduction	3	Black Board
5.6	*Lepidodendron* - Structure and Reproduction	3	Black Board
TOTAL		90	

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Programme Code-UBO

Course Code	Course Title	Category	L	T	P	Credit
UBO19CL21	**Plant Diversity II Lab**	**Core Lab-2**		**-**	**4**	**2**

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

#	Course Outcome	Knowledge Level (according to Bloom's Taxonomy)
CO1	Identify Pteridophytes and Gymnosperms based on their morphology	K1
CO2	Distinguish the life forms at generic level based on anatomical variations	K2
CO3	Diagnosethe morphological variations of vascular cryptogams and early flowering plants	K1,K2
CO4	Recognizethe significance of fossil forms	K3

K1 - Knowledge K2 - Understand K3 – Apply

Mapping of Course Outcomes with Programme Specific Outcomes

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

S-Stong M-Medium L-Low

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

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

Study of internal organization of the following using permanent slides

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

Study ofFossil types

10. *Rhynia* stem
11. *Lepidodendron*

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Programme Code-UBO

Course Code	Course Title	Category	L	T	P	Credit
UBO19AE21	**Personality Development**	AECC2	2	-	-	

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

Preamble

Impart quality education to the students for integrated ***personality development*** based on life skills and value systems.

Course Outcomes

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

	Course outcomes	Knowledge Level
CO1	Define and will posses different life skill strategies required for self development	K1,K2
CO2	Make use of the skills learnt effectively to meet the challenges and opportunities.	K3
CO3	Make use of skills learnt to meet or face harsh situation (conflict management)	K3
CO4	Develop life long learning, maintaining quality and relevance, according to changing requirement particularly of emerging knowledge economy	K3
CO5	Spell the importance and acquire various skills that make them employable and to secure a decent job.	K1,K3

K1: Knowledge K2: Understand K3: Apply

Mapping of Course Outcomes with Programme Specific Outcomes

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

S-Strong M-Medium L-Low

Blooms taxonomy: Assessment Pattern

	CA		End of Semester
	First	Second	
Knowledge	40%	40%	40%
Understand	40%	40%	40%
Apply	20%	20%	20%
Total	52	52	140

Unit I
Life skill strategies- Effective communication, Creative thinking, Decision making, Goal setting, Problem solving, Resume writing.

Unit II
Attitude, Interpersonal Skills, self awareness, SWOT, Emotional Intelligence, Leadership development- Team building, Time, stress and conflict management.

Textbooks
N.Chockan 2011 Learn to understand others,Prodigy books, Chennai
Machakkalai,R andL. Saraswathi 2005.Personality development a need.mangai Publishers, Madurai

Reference books
S.P.Sharma 2005. Youngsters guide for Personality development.Pustak Mahal, New Delhi
Sean Convey 1998. The 7 habits of highly effective teens.Fireside New York, USA.

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Programme Code-UBO

Course Code	Course Title	Category	L	T	P	Credit
UBO19C31	**Microbiology and Plant pathology**	**Core-3**	**3**	**-**	**-**	**4**

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

Preamble

To equip the students with the basic principles of microbiology and plant pathology, updated techniques in applied aspects of methods of isolation of all kinds of microbes including pathogens.

Course Outcomes

On completion of the course the student will be able to

#	Course Outcome	Knowledge Level (according to Bloom's Taxonomy)
CO1	Explain the basic principles and history of microbes	K1
CO2	Classify the various kinds of microbes	K2
CO3	Demonstrate the techniques of sterilization, media preparation, Plating, pure culture techniques and culture preservation	K3
CO4	Explore the knowledge about epidemiology and symptomatology of plant diseases.	K1,K2
CO5	Exhibit the technique in field area where ever the disease spread over.	K3

K1 - Knowledge K2 - Understand K3 - Apply

Mapping of Course Outcomes with Programme Specific Outcomes

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

S-Stong M-Medium L-Low

Blooms taxonomy: Assessment Pattern

	CA		End of Semester
	First	Second	
Knowledge	40%	40%	40%
Understand	40%	40%	40%
Apply	20%	20%	20%
Total	52	52	140

Unit I: History of microbiology-Invention of microscopes- Reddy's experiments-Fermentation- Koch's postulates-Virus discoveries- discovery of antibiotics, general account of microbes, classification of bacteria – Whittaker's five kingdom, Bergey‘s manual 8th ed.,

Unit II: Bacteria – Ultra structure and reproduction-binary fission-Conjugation, Transformation, Transduction. Virus -structure and replication-bacterial phage and TMV.

Unit III: Bacterial nutrition, media types – Bacterial Growth- Factors affecting growth. -Sterilization methods-Pure culture techniques and plating methods. Staining techniques: Simple and Gram‘s staining -Preservation of microbial cultures.

Unit IV: Plant pathology Introduction, history, Concept, Importance, diagnosis and classification Inoculum, penetration, infection, invasion, and dispersal – plant defense mechanism (enzymes, and toxins). Epidemiology: forms, reasons of progressive severity of epidemics and decline of epidemics. Recent methods of plant disease forecasting.

Unit V: Symptomatology Study of the following diseases, symptom manifestation and disease control measures. 1. Citrus canker, 2. Cotton blight, 3. Tikka disease of groundnut 4. Cucumber Mosaic virus 5. Smut of Sorghum 6. Red rot of Sugar cane 7. Phyllody of drumstick.

Text Books:

1) Ananthanarayanan, R. and C.K. JayaramPaniker. 1996. Text book of Microbiology. Orient Longman, Hyderabad.
2) Aneja, K.R. 1996. Experiments in Microbiology, Plant pathology, Tissue culture and Mushroom Cultivation. VishwaPrakashan (New Age International (p) Ltd.) New Delhi.
3. Puvanakrishnan, R., Sivasubramanian, S. And T. Hemalatha.2015.Microbes and Enzymes-Basics and Applied.MJP Publishers.
4. Kalaichelvan, P.T.2008. Microbiology and Biotechnology-a lab Manual. Lab Man Series, MJP Publishers.
5. Vijaya Ramesh, K. 2008.Environmental Microbiology. MJP Publishers.
6. Rangaswamy, G. 1975. Diseases of crop plants in India. 2nd Edn. Prentice Hall, India Books.
7) Pandey, B.P 1997. Plant pathology. S.Chand and Co. Ltd., New Delhi.
8) Mehrothra, R.S. 1980. Plant pathology, Tata McGraw Hill Publishing Company Ltd., New Delhi.

Reference Books:

1) Pelczar, M.J., E.C.S. Chan and N.R Krieg. 2010. Microbiology-Concepts and applications, Tata McGraw-Hill Publishing Company, New Delhi.
2) Prescott, L.M., J.P. Harley, and D.A .Klein. 2002. Microbiology, McGraw -Hill Publishing Company, New Delhi.
3) Bhatia, A.L. 2005. Handbook of Microbiology, Pointer Publishers, Jaipur.
4) Ingram, J.L. and C.A. Ingram. 2004. Introduction to Microbiology, Thomson Books, UK
5) Agrios, G.N.2006. Plant pathology, Fifth edition, Academic Press, New York.
6) Singh, R.S. 2009. Plant Diseases, Oxford & IBH Publishing Co.Pvt. Ltd., New Delhi.

Course designers

1. Dr.B.SADHANA2. Dr. V.KARTHIKEYAN

Lecture Schedule

	Topic	No of lecture hrs.	Method
1.1	History of microbiology	3	Black Board
1.2	general account of microbes	2	Green Board, group discussion
1.3	classification of bacteria – Whittaker's five kingdom	2	PPT
1.4	Bergey's manual 8th ed.,	2	Black Board, PPT, Group discussion
2.1	Bacteria – Ultra structure and reproduction- binary fission	2	PPT
2.2	Conjugation, Transformation, Transduction	3	PPT
2.3	Virus -structure and replication-bacterial phage	3	Black Board, PPT
2.4	TMV	1	Black Board
3.1	Bacterial nutrition, media types – Bacterial Growth- Factors affecting growth.	3	Black Board, PPT
3.2	Sterilization methods- Pure culture techniques and plating methods.	3	Black Board, PPT
3.3	Staining techniques: Simple and Gram's staining	2	PPT, Group discussion
3.4	Preservation of microbial cultures.	1	PPT
4.1	Plant pathology Introduction, history, Concept, Importance, diagnosis.	2	Green Board, Group discussion
4.2	classification Inoculum, penetration, infection, invasion, and dispersal	3	Green Board, PPT
4.3	plant defense mechanism (enzymes, and toxins).	2	Green Board,
4.4	Epidemiology: forms, reasons of progressive severity of epidemics and decline of epidemics. Recent methods of plant disease forecasting.	2	Green Board,
5.1	Symptomatology Study of the following diseases, symptom manifestation and disease control measures. 1. Citrus canker, 2. Cotton blight	3	Green Board, PPT, group discussion
5.2	3. Tikka disease of groundnut 4. Cucumber Mosaic virus	3	Green Board
5.3	5. Smut of Sorghum 6. Red rot of Sugar cane	2	Green Board, PPT
5.4	7. Phyllody of drumstick	1	Green Board
Total		45	

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Programme Code-UBO

Course Code	Course Title	Category	L	T	P	Credit
UBO19C32	**Cell Biology and Plant Anatomy**	**Core-4**	**3**	**-**	**-**	**4**

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

Preamble

To provide the idea about the organization of plants at cellular as well as tissue level

Course Outcomes

On completion of the course the student will be able to

#	Course Outcome	Knowledge Level (according to Bloom's Taxonomy)
CO1	Explain the basic cellular organization of plants	K1
CO2	Distinguish different types of plant tissues through their structural organization and functions	K2
CO3	Reveal the functions of cell organelles and tissues	K2
CO4	Elucidate the development of shoot and root	K2
CO5	Reason out the organization and complexity of tissue types	K3

K1 - Knowledge K2 - Understand K3 - Apply

Mapping of Course Outcomes with Programme Specific Outcomes

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

S-Stong M-Medium L-Low

Blooms taxonomy: Assessment Pattern

	CA		End of Semester
	First	**Second**	
Knowledge	40%	40%	40%
Understand	40%	40%	40%
Apply	20%	20%	20%
Total	52	52	140

Title of the paper Cell Biology and Anatomy

Unit I: Plant and animal cell - ultra structure. Plant cell – structure of cell wall, Plasma membrane – Fluid mosaic model. Structure and function of cytoplasmic organelles- Cytosol – cytoskeleton organization — endoplasmic reticulum – peroxisomes –lysosomes – vacuoles – ribosome – golgi apparatus- ergastic substances.

Unit II: Mitochondria –Plastids- structure and function. Nucleus – structure and function. Structure of chromosome – Euchromatin – heterochromatin – abnormal structure in chromosome – lampbrush and polytenestructures.Cell cycle – mitosis – meiosis.

Unit III: Meristematic tissues – Characters and types – structure and function of apical meristems – root apex and shoot apex – theories of meristems: Root apex-Histogen theory and Shoot apex- Tunica-Corpus theory. Structure and function of simple tissues– parenchyma, collenchyma, sclerenchyma.Secretarytissues.Structure of surface appendages-trichomes, glands.

Unit IV: Complex tissues- xylem, phloem. Types, structure and function of cambium. Primary structures of dicot root (*Vigna*), monocot root (*Maize*), dicot stem (*Vigna*), monocot stem (*Maize*), dicot leaf (*Tridax*) and monocot leaf (*Grass*).

Unit V: Secondary growth: normal secondary growth in dicot stem. Anomalous secondary growth in *Boerhaavia*. Nodal anatomy: unilacunar node (*Polyalthia*), trilacunar node (*Azadirachta*) and multilacunar node (*Aralium*).

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.

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.

Course designer

1. Dr. K.Saraswathi

Lecture Schedule

	Topic	No of lecture hrs.	Method
1.1	Plant - ultra structure	1	Black Board
1.2	Animal cell- ultra structure	1	Black Board
1.3	Cell Wall&Plasma Membrane	1	Black Board
1.4	Cytosol and Cytoskeleton	1	Black Board and PPT
1.5	Endoplasmic reticulum	1	Black Board
1.6	Peroxisomes&Lysosomes	1	Black Board
1.7	Vacuoles&Ribosomes	1	Black Board
1.8	Golgi apparatus Ergastic substances	1	Black Board
2.1	Mitochondria	1	Black Board
2.2	Plastids	1	Black Board
2.3	Nucleus	1	Black Board
2.4	Chromosome – structure	2	Black Board
2.5	Abnormal chromosome	1	Black Board
2.6	Cell cycle	1	PPT
2.7	Mitosis	2	Black Board and Practical Observation
2.8	Meiosis	3	Black Board and Practical Observation
3.1	Meristem- characters, types, organization	2	Black Board
3.2	Root and Shoot apex theories	1	Black Board
3.3	Parenchyma	2	Black Board and Practical Observation
3.4	Collenchyma	1	Black Board and Practical Observation
3.5	Sclerenchyma	1	Black Board and Practical Observation
3.6	Secretary tissues	1	Black Board and Practical Observation
3.7	Trichomes	1	Black Board and Practical Observation
4.1	Xylem	1	Black Board and Practical Observation
4.2	Phloem	1	Black Board and Practical Observation
4.3	Cambium	1	Black Board
4.4	Dicot root and Stem	2	Black Board and Practical Observation
4.5	Monocot root and stem	1	Black Board and Practical Observation
4.6	Dicot Leaf and Monocot Leaf	2	Black Board and Practical Observation
5.1	Normal Secondary growth in dicot stem	2	Black Board and Practical Observation
5.2	Anomolous secondary growth in *Boerhaavia*	2	Black Board and Practical Observation
5.3	Nodal Anatomy	3	Black Board and Practical Observation
TOTAL		45	

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Department of Botany

(For those joined B. Sc., Botany on or after June 2019)

Programme Code-UBO

Course Code	Course Title	Category	L	T	P	Credit
UBO19CL31	Microbiology and Plant pathology, Cell biology and Anatomy Lab	Core Lab-3	-	-	2+2=4	2

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

Preamble

To equip the students with the basic principles of microbiology and plant pathology and updated techniques in applied aspects of methodologies for isolation of all kinds of microbes including pathogens.

To equip the students with the basic techniques of plant anatomical sections and observe the structure microscopically.

Course Outcomes

On completion of Microbiology and plant pathology lab course the student will be able to

#	Course Outcome	Knowledge Level (according to Bloom's Taxonomy)
CO1	Classify the various kinds of microbes and its handling	K1
CO2	Demonstrate the techniques of sterilization, media preparation, Plating, pure culture techniques and culture preservation	K2
CO3	Explore the knowledge about epidemiology and symptomatology of plant diseases.	K1,K2
CO4	Exhibit the technique in field area where ever the disease spread over.	K3

On the completion of the Cell biology and Anatomy lab course the student will be able to

#	Course Outcome	Knowledge Level (according to Bloom's Taxonomy)
CO1	Classify the plant parts according to its internal structure	K1
CO2	Demonstrate the sectioning of plant parts	K2
CO3	identify different plants	K3
CO4	Exhibit all unknown inclusion components distribution study.	K3

K1 - Knowledge K2 - Understand K3 – Apply

Mapping of Course Outcomes with Programme Specific Outcomes

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

S-Strong M-Medium L-Low

Title of the paper Microbiology and Plant pathology Practicals

1. Microbiology Lab Practices
2. Media preparation and plating techniques.
3. Bacterial staining – simple staining and Grams staining.
4. Fungal staining-Lacto phenol cotton blue staining.
5. Isolation of microbes from various samples:soil,water,airetc.,
6. Observing bacterial motility by hanging drop method.
7. Study of the following diseased plant materials: a) Mildew and brown rust b) Red rot and leaf spot of Ground nut c) Canker, Red rust and white rust.
8. Demonstration of the isolation of pathogen from diseased material.
9. Submission of 5 herbarium sheets of infected plant materials –Valued externally.

Cell Biology and Plant Anatomy Practicals

1. Cell division: Mitosis – Onion root tip squash
2. Study of cell inclusions – Starch grain from banana, rice and potato
3. Study of cell inclusions - Cystolith (*Ficus*leaf), Raphides (*Pothos*leaf)
4. Study of the internal structure of Dicot root – *Vigna*
5. Monocot root- *Maize*
6. Dicot stem – *Vigna*
7. Monocot stem – *Maize*
8. Dicot leaf – *Tridax*
9. Monocot leaf- *Grass*
10. Normal secondary growth :*Tecoma*stem
11. Anomalous secondary growth :*Boerhaavia*stem
12. Nodal Anatomy – *Polyalthia, Azadirachta, Albizzia*

Course designers
1. Dr.B.SADHANA
2. Dr. V.KARTHIKEYAN

Lecture Schedule

	Topic	No of lecture hrs.	Method
1	Microbiology Lab Practices	2	Group practices
2	Media preparation and plating techniques.	4	Black board
3	Bacterial staining – simple and Grams staining.	4	Individual practice, Slide submission
4	Fungal staining-Lacto phenol cotton blue staining.	2	Individual practice, Slide submission
5	Isolation of microbes from various samples:soil,water,air,etc.	4	Black board, Group practices
6	Observing bacterial motility by hanging drop method.	2	Individual practice, Slide submission
7	Study of the following diseased plant materials: a) Mildew and brown rust b) Red rot and leaf spot of Ground nut c) Canker, Red rust and white rust.	4	Individual practice, Slide submission
8	Demonstration of the isolation of pathogen from diseased material.	4	Individual practice and demonstration
9	Submission of 5 herbarium sheets of infected plant materials –Valued externally.	4	Individual practice, Herbarium
Total		30	

	Topic	No of practical hrs.	Method
1	Cell division: Mitosis – Onion root tip squash	4	Individual practice
2	Study of cell inclusions – Starch grain from banana, rice and potato	2	Individual practice
3	Study of cell inclusions - Cystolith (*Ficus*leaf), Raphides (*Pothos*leaf)	4	Individual practice, Slide submission
4	Study of Internal structure of Dicot root – *Vigna*	2	Individual practice
5	Monocot root- *Maize*	2	Individual practice, Slide submission
6	Dicot stem – *Vigna*	2	Individual practice
7	Monocot stem – *Maize*	2	Individual practice,
8	Dicot leaf – *Tridax*	2	Individual practice, Slide submission
9	Monocot leaf- *Grass*	2	Individual practice, Slide submission
10	Normal secondary growth : *Tecoma*stem	2	Individual practice, Slide submission
11	Anomalous secondary growth : *Boerhaavia*stem	2	Individual practice, Slide submission
12	Nodal Anatomy – *Polyalthia, Azadirachta, Albizzia*	4	Individual practice, Slide submission
Total		30	

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Programme Code-UBO

Course Code	Course Title	Category	L	T	P	Credit
UBO19NE31	**Gardening**	**NME -1**	**2**	**-**	**-**	**2**

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

Preamble
To equip the students with the basic ideas of various components of ornamental garden, kitchen garden.

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

#	Course Outcome	Knowledge Level (according to Bloom's Taxonomy)
CO1	Explain the components of garden	K1,
CO2	Choice of plants and maintenance	K2
CO3	Preparing layout of Kitchen garden	K3
CO4	Skills in flower arrangement	K1

K1 - Knowledge K2 - Understand K3 - Apply

Mapping of Course Outcomes with Programme Specific Outcomes

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

GARDENING

Unit I: Ornamental garden and its components: Climbers & creepers- trees-shrubs- rock garden, water garden- Hedges & Edges- Lawn-Flower beds-Path- Indoor garden: Choice of plants and Maintenance
Unit II: Bottle garden-Hanging pots- Bonsai- Kitchen garden: Layout and choice of plants-Flower arrangement; Different designs and do's and don'ts – Dry flower preparation and arrangement- Preparation of Greeting cards.

Text Books:

1) Rao, K.M.1991. Text book of Horticulture. Mac Millan India Ltd. New Delhi.
2) Vishnu Swarup. 1999. Ornamental horticulture. Mac Millan India Ltd, New Delhi.
3) Chandha,K.L 2001. Hand book of Horticulture, ICAR, New Delhi.
4) Carrol, L., J.R. Shry and H.E. Reiley. 2012. Introductory Horticulture, Eighth Edition,
http://longfiles.com/dzmokym4pdli/Introductory.horticulture.8e.pdf.html

Lecture Schedule

Unit	Topic	Lecture hrs.	Method
1.1	Ornamental garden and its components	1	Black Board
1.2	Climbers & creepers- trees-shrubs	1	Black Board
1.3	rock garden, Lawn	1	Black Board
1.4	water garden	1	PPT
1.5	Hedges & Edges, Flower beds-Path- Indoor garden: Choice of plants and Maintenance	1	Black Board
2.1	Bottle garden-Hanging pots	1	Black Board
2.2	Bonsai	1	Black Board
2.3	Kitchen garden: Layout and choice of plants	1	Black Board
2.4	Flower arrangement; Different designs and do‘s and don‘ts – Dry flower preparation and arrangement	1	Black Board
2.5	Preparation of Greeting cards.	1	Black Board
Total			

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Programme Code-UBO

Course Code	Course Title	Category	L	T	P	Credit
UBO19C41	Plant Embryology and Tissue culture	Core-5	3	-	-	4

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

Preamble

To equip the students with the basic principles of biotechnology, updated methodologies, techniques applied aspects of Plant Biotechnology

Course Outcomes

On completion of the course the student will be able to

#	Course Outcome	Knowledge Level (according to Bloom's Taxonomy)
CO1	Explain the fundamentals of plant embryology	K1
CO2	Study the Anther and pollen grains – Structure and development of microsporangium	K2
CO3	differentiate types of pollination - Types of fertilization– Endosperm types	K2
CO4	Define the basic principles and techniques involved in plant tissue culture	K3
CO5	Haploid production–Androgenesis, Gynogenesis, Applications of tissue culture	K3

K1 - Knowledge K2 - Understand K3 – Apply

Mapping of Course Outcomes with Programme Specific Outcomes

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

S-Strong M-Medium L-Low

Blooms taxonomy: Assessment Pattern

	CA		End of Semester
	First	Second	
Knowledge	40%	40%	40%
Understand	40%	40%	40%
Apply	20%	20%	20%

Unit I: Flower: Essential and Nonessential parts-Sepals, Petals (non-essential), Androeciumand Gynoecium (essential) – Androecium of flowers: Anther and pollen grains – Structure and development of microsporangium – Development of male gametophyte. Gynoecium of flowers: Structure and development of mega sporangium- Development of female gametopyte, Structure and types of ovules.

Unit II: Pollination: Kinds of pollination (Self and Cross)- Fertilzation: Types of fertilization(Porogamy, Chalazogamy and Mesogamy), Process and significance of double fertilization and triple fusion, Post fertilization changes; Endosperm: Types-Nuclear, Cellular and Helobial, Embryo: Structure and Development – Monocot embryo- Luzula, Dicot embryo-*Capsella*- Polyembryony.

Unit III: History of plant tissue culture, Nutrient media: Commonly used culture mediacomposition. The concept of totipotency of cells, Role of plant hormones in tissue culture, various types of cultures: callus, cell suspension, root, meristem and anther culture.

Unit IV: Micro propagation, Organogenesis–Formation of shoots and roots, Somaticembryogenesis, process of somatic embryogenesis, Synthetic seeds – Applications.

Unit V: Haploid production–Androgenesis, anther and pollen culture, Gynogenesis–Ovaryand ovule culture, plantlets from haploids, protoplast culture and regeneration, transgeneic plants and their uses, Applications of tissue culture in forestry, horticulture, agriculture and pharmaceuticals industry.

Test Books:

Rahavan, V. 1976. Experimental Embryogenesis in vascular plants, Academic Press, London.

Maheswari, P. 1963. An Introduction to Embryology of Angiosperms, International Society of plant Morphologies, New Delhi.

Smith, R.H. 1992. Plant Tissue Culture. Techniques and experiments, Academic Press, Sandiego.

Dubey, R.C. 2001. A Text book of biotechnology, S chand& Co., New Delhi.

Kalyankumar, D.E. 2008. Plant Tissue Culture, New Central Book Agency, Calcutta.

Reference Books:

Bhojwani, S.S and Razdan, M.K. 2004. Tissue culture: Theory and Practice, Elsevier, New Delhi.

Purohit, S.S.2010. Plant Tissue Culture, Student edition, S.S.Publication, Jodhpur.

Smith, R.2012. Plat Tissue culture, Techniques and Experiments, Third edition, Academic Press, Sandiego.

Bhojwani, S.S and Dantu, P.K. 2013. Plant Tissue Culture, Springer, India.

Course Designers:

Dr.M.Viji

Dr.K.Sathiyadash

Lecture Schedule

Unit	Topic	Lecture hrs	Method
1.1	Flower: Essential and Nonessential parts-Sepals, Petals (non-essential), Androeciumand Gynoecium (essential) – Androecium of flowers	2	Black Board
1.2	Anther and pollen grains – Structure and development of microsporangium	2	Power Point
1.3	Development of male gametophyte.	2	Smart Board
1.4	Structure and development of mega sporangium-Development of female gametopyte,	3	Black Board
1.5	Structure and types of ovules.	2	Power Point
2.1	Pollination: Kinds of pollination (Self and Cross)-Fertilzation: Types of fertilization(Porogamy, Chalazogamy and Mesogamy),	2	Black Board
2.2	Process and significance of double fertilization and triple fusion, Post fertilization changes;	3	Power Point
2.3	Endosperm: Types-Nuclear, Cellular and Helobial,	2	Group Discussion
3.1	Embryo: Structure and Development – Monocot embryo-Luzula, Dicot embryo-*Capsella*- Polyembryony.	3	Black Board
3.2	History of plant tissue culture, Nutrient media: Commonly used culture mediacomposition.	3	Power Point
3.3	The concept of totipotency of cells, Role of plant hormones in tissue culture.	3	Power Point
4.1	Various types of cultures: callus, cell suspension, root, meristem and anther culture.	3	Power Point/Demonstration
4.2	Micro propagation, Organogenesis–Formation of shoots and roots,	3	Black Board
4.3	Somaticembryogenesis, process of somatic embryogenesis, Synthetic seeds – Applications.	3	Black Board
5.1	Haploid production–Androgenesis, anther and pollen culture	3	Black Board
5.2	Gynogenesis–Ovaryand ovule culture, plantlets from haploids	2	Black Board
5.3	Protoplast culture and regeneration, transgeneic plants and their uses,	2	Black Board
5.4	Applications of tissue culture in forestry, horticulture, agriculture and pharmaceuticals industry.	2	
Total		**45**	

Thiagarajar College (Autonomous): Madurai – 625 009

Department of Botany

(For those joined B. Sc., Botany on or after June 2019)

Programme Code-UBO

Course Code	**Course Title**	**Category**	**L**	**T**	**P**	**Credit**
UBO19C42	**Bioinstrumentation and Computer Applications**	**Core-6**	**3**	**-**	**-**	**4**

Year	**Semester**	**Int. Marks**	**Ext.Marks**	**Total**
Second	Fourth	25	75	100

Preamble

To equip the students with basic principles, standard procedures and advanced applications of instruments used in field of plant biology.

Course Outcomes

On completion of the course the student will be able to

#	Course Outcome	Knowledge Level (according to Bloom's Taxonomy)
CO1	Explain the basic principles of microscopy and colorimetry	K1
CO2	Distinguish between the types of chromatorgaphy	K2
CO3	Demonstrate the separation of various biomolecules	K2
CO4	Depict the usage of computers and internet	K3
CO5	Prepare word, chart, graph and presentations using application software	K3

K1 - Knowledge K2 - Understand K3 – Apply

Mapping of Course Outcomes with Programme Specific Outcomes

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

S-Strong M-Medium L-Low

Blooms taxonomy: Assessment Pattern

	CA		**End of Semester**
	First	**Second**	
Knowledge	40%	40%	40%
Understand	40%	40%	40%
Apply	20%	20%	20%
Total	52	52	140

Title of the paper Bioinstrumentation and Computer Applications

Unit I: Microscopy – working principle, instrumentation and applications of light, phase contrast, dark field, electron microscopy (TEM and SEM) and Confocal microscopy. pH meter – principle, techniques and maintenance, Colorimetry- Beer – Lambert's law, principle, techniques and applications of colorimeter.

Unit II: Chromatography - Principle, instrumentation and applications - paper, adsorption, partition, thin layer chromatography, gas chromatography, high performance liquid chromatography, ion exchange and affinity chromatography;

Unit III: Electrophoresis – principle - paper and gel electrophoresis (AGE and PAGE), Centrifugation- principle, types (bench top, refrigerated, high speed and ultra centrifuge), instrumentation and applications.

Unit IV: Introduction to Computers: Generations of Computer. Computer applications in various fields of biology; History and usage of Internet, Browser and its types, Electronic Mail (e-mail) and Intranet.

Unit V: Hardware: CPU, Primary and secondary storage – RAM, ROM, Hard Disc, CD, DVD, Pen drive, SD Card. Input/Output devices -, Key board, Mouse, Scanner, Web cam, Microphone, Joy stick, VDU, Printers (Dot matrix, Inkjet and Laser). Application software: MS-word, Excel and PowerPoint.

Text Books:

1. Jain, J. L. 2000. Fundamentals of Biochemistry. S. Chand & Co. Ltd., New Delhi.
2. Satyanarayana, U. and U. Chakrapani, 2013. Biochemistry. Elsevier Co-published with, Books and Allied Press, New Delhi
3. Suresh K, Pasandra. 1997. Computer today. Galcotia Publications, New Delhi.
4. Saxena, S. 2009. MS-Office for everyone, Vikas publishing House Pvt. Ltd., Noida, UP.
5. Sunkin, M.G. 1992. Introduction to computer information System for business. S.Chand& Co., New Delhi

References:

1. Nelson, D. L. and M. M. Cox. 2008. Lehninger Principles of Biochemistry. W. H. Freeman Publishers, New York.
2. Berg, *J. M., J. L.* Tymoczko and L. *Stryer*, 2010. Biochemistry, W. H. Freeman, Publishers, New York.
3. Mousumi-Debnath. 2005. Tools and Techniques of Biotechnology. Pointer publisher, Jaipur. 4.Taxali, R.K. 2000. PC software for Windows – Made simple, Tata McGraw-Hill publishing, company Ltd., New Delhi.

Course Designer

1. Dr. K. Sathiyadash

Lecture Schedule

Unit	Topic	Lecture hrs.	Method
1.1	Microscopy – working principle, instrumentation and applications of light, phase contrast, dark field	3	Black Board
1.2	Electron microscopy (TEM and SEM) and Confocal microscopy	3	Power Point
1.3	pH meter – principle, techniques and maintenance	2	Smart Board
1.4	Colorimetry- Beer – Lambert's law, principle, techniques and applications of colorimeter	2	Demonstration, Hands-on Training, ICT Method
2.1	Chromatography - Principle, instrumentation and applications	2	Hands-on Training, ICT method
2.2	Paper, adsorption, partition and thin layer chromatography,	3	Demonstration, Hands-on training
2.3	Gas chromatography, high performance liquid chromatography, ion exchange and affinity chromatography	3	Black Board
3.1	Electrophoresis – principle - paper and gel electrophoresis (AGE and PAGE)	2	Demonstration
3.2	Centrifugation- principle, types (bench top, refrigerated, high speed and ultra centrifuge),	3	Power Point
3.3	Centrifuge - instrumentation and applications.	2	Power Point
4.1	Introduction to Computers: Generations of Computer. Computer applications in various fields of biology	3	Peer group Learning
4.2	History and usage of Internet, Browser and its types	2	Black Board
4.3	Electronic Mail (e-mail) and Intranet	1	ICT Method
5.1	Hardware: CPU, Primary and secondary storage	3	Black Board
5.2	RAM, ROM, Hard Disc, CD, DVD, Pen drive, SD Card	4	Black Board
5.3	Input/Output devices -, Key board, Mouse, Scanner, Web cam, Microphone, Joy stick, VDU, Printers (Dot matrix, Inkjet and Laser).	4	Black Board
5.4	Application software: MS-word, Excel and PowerPoint.	3	Power point
Total		**45**	

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Department of Botany
(For those joined B. Sc., Botany on or after June 2019)
Programme Code-UBO

Course Code	Course Title	Category	L	T	P	Credit
UBO19CL41	Plant Embryology and Tissue Culture, Bioinstrumentation and Computer Applications Lab	Core Lab-4	-	-	2+2=4	2

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

Preamble

To equip the students with the basic principles of plant embryology and updated techniques in applied aspects of methodologies for isolation and culture of plant cells

To equip the students with basic principles, standard procedures and advanced applications of instruments used in field of plant biology

Course Outcomes

On completion ofPlant Embryology and Tissue Culture Labstudents will be able to

#	Course Outcome	Knowledge Level (according to Bloom's Taxonomy)
CO1	Dissect out embryo from seed	K1
CO2	Demonstrate the techniques of sterilization, explants preparation	K2
CO3	Explain the principles of tissue culture	K1,K2
CO4	Exhibit the technique of protoplast isolation and fusion	K3

On completion of Bioinstrumentation and Computer ApplicationsLab the students will be able to

#	Course Outcome	Knowledge Level (according to Bloom's Taxonomy)
CO1	Explain the basic principles of microscopy and colorimetry	K1
CO2	Distinguish between the types of chromatorgaphy	K2
CO3	Depict the usage of computers and internet	K3
CO4	Prepare word, chart, graph and presentations using application software	K3

K1 - Knowledge K2 - Understand K3 – Apply

Mapping of Course Outcomes with Programme Specific Outcomes

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

S-Strong M-Medium L-Low

Plant Embryology and Plant Tissue CulturePracticals

1.Preparation of Murashige and Skoog medium
2.Explants Preparation
3.Callus induction in tobacco leaf disc, regeneration of shoots, root induction, role ofhormones in
morphogenesis
4.Cell suspension culture initiation from tobacco callus cultures
5.Isolation of protoplast from leaves
6.Demonstration of protoplast isolation from fungi
7.Demonstration of protoplast fusion using PEG
8.Study of slides showing developmental stages of anther, embryo sac, endosperm and embryo
9.Study of different types of pollen grains
10.Dissection of endosperm haustoria –Cucumis
11.Dissection of embryo –Tridax

Bioinstrumentation and Computer Application Practicals

1. Measurement of cells using ocular micrometer
2. Determination of pH
3. Verification of Lambert –Beers law
4. Determination of sedimentation co-efficient using centrifuge
5. Separation of plant pigments using paper chromatography
6. Separation of mixture of dyes using paper chromatography
7. Separation of plant pigments using thin layer chromatography
8. Separation of mixture of dyes using thin layer chromatography
9. Demonstration of Agarose gel electrophoresis
10. Creation of table using Microsoft word
11. Creation of column, bar, line, pie and scatter chart using spread sheet
12. Calculation of Mean, Sum, Standard deviation using spread sheet and formula setting.
13. Creation of professional quality presentation using MS-office power point

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Department of Botany

(For those joined B. Sc., Botany on or after June 2019)

Programme Code-UBO

Course Code	Course Title	Category	L	T	P	Credit
UBO19SE41(A)	Histology and Staining Techniques	(Skill Enahncement Course - 1)	**2**	**-**	**-**	**2**

Year	Semester	Int. Marks	Ext.Marks	Total
Seond	Fourth	15	35	50

Preamble

To equip the students with the basic principles of histology and technical aspects of Staining Techniques

Course Outcomes

On completion of the course the student will be able to

#	Course Outcome	Knowledge Level (according to Bloom's Taxonomy)
CO1	Explain the basic principles of Histology, Histological classification of cells	K2
CO2	To distinguish types of simple and compound tissues	K1
CO3	Study the principles of microscopes, Compound microscope	K3
CO4	Microtome techniques- Preparation of permamnat slides	K3

K1 - Knowledge K2 - Understand K3 - Apply

Mapping of Course Outcomes with Programme Specific Outcomes

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

S-Strong M-Medium L-Low

Blooms taxonomy: Assessment Pattern

	CA		End of Semester
	First	**Second**	
Knowledge	40%	40%	40%
Understand	40%	40%	40%
Apply	20%	20%	20%
Total	30	30	65

Unit-I: Histology-Introduction- histological classification of cells, types of plant tissues-simpleand compound tissues- microscopic examination of cells- Microscopy: Principles, structure and maintenance of compound microscope, magnification, resolving power, Different applications of microscopes. A brief account on maceration technique.

Unit-II: Microtome techniques: Microtomy-types of microtome, Killing and Fixation,Dehydration, Stains and staining. Sections: free hand sections, and serial sections-Selected methods for preparation of permanent slides.

Text books:

Prasad, M.K. and Prasad M.Krishna. 1975. Outlines of Microtechniques, Emkay publications. Delhi.

Periyasamy, K. 1980. Histochemistry, developmental and structural anatomy of angiosperms: a symposium, P & B publications, Tiruchirapalli.

Reference Books:

Penney, D.P., J.M.Powers, M.Frank and C. Churukian. 2002. Analysis and testing of biological stains—the Biological Stain Commission Procedures, Biotech Histochem. 77 (5–6): 237–275. PMID 12564600.

Clark, G.1981. Staining Procedures, Fourth edition, Baltimore: Williams & Wilkins

Histological techniques: Microtomy; http://www.histologicaltechniques.

Course designers

Dr. K. Jegathesan and Dr. M. Viji

Lecture Schedule

Unit	**Topic**	**Lecture h**	**Method**
1.1	Histology-Introduction- histological classification of cells, types of plant tissues-simpleand compound tissues	4	Black Board
1.2	Microscopic examination of cells- Microscopy: Principles, structure and maintenance of compound microscope, magnification, resolving power,	4	Power Point
1.3	Different applications of microscopes	3	Smart Board
1.4	A brief account on maceration technique	2	Smart Board
1.5	Microtome techniques: Microtomy-types of microtome	2	Power Point
2.1	Killing and Fixation,Dehydration, Stains and staining	5	Black Board
2.2	Sections: free hand sections, and serial sections-	5	Power Point
2.3	Selected methods for preparation of permanent slides.	5	Power Point
Total		**30**	

Thiagarajar College (Autonomous): Madurai – 625 009
Department of Botany
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Programme Code-UBO

Course Code	Course Title	Category	L	T	P	Credit
UBO19SE41(B)	**Biofertilizers and Organic farming**	(Skill Enahncement Course - 1)	**2**	**-**	**-**	**2**

Year	Semester	Int. Marks	Ext.Marks	Total
Seond	Fourth	15	35	50

Preamble
To equip the students with the basic principles of biofertilizers and organic farming Techniques

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

#	Course Outcome	Knowledge Level (according to Bloom's Taxonomy)
CO1	Isolate, identify and mass multiply biofertilizers	K1
CO2	Isolate, identify and mass multiply biofertilizers	K2
CO3	Explain the benefits of organic farming	K3
CO4	Demonstrate the production of vermicompost	K3

K1 - Knowledge K2 - Understand K3 - Apply

Mapping of Course Outcomes with Programme Specific Outcomes

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

S-Strong M-Medium L-Low

Blooms taxonomy: Assessment Pattern

	CA		End of Semester
	First	**Second**	
Knowledge	40%	40%	40%
Understand	40%	40%	40%
Apply	20%	20%	20%
Total	30	30	65

Unit I: Biofertilizers: Introductionand scope. A general account of Biofertilizers organisms - Algae (BGA), Bacteria and Mycorrhizae. Mass cultivation of Azolla. Bactrria –Rhizobium and its mass production. Phosphate solubilizing bacterial biofertilizers -Pseudomonasand its mass multiplication, Fungal biofertilizers –Mycorrhiza.

Unit II: Organic farming:Concept, definition and applications. Organic residues,soil biota and decomposition of organic residues, organic manures, composting, vermicompost, green manures-production and application methods of organic manures. Marketing of organic products

Text books:

1. Dubey, R.C.2002. A Text book of biotechnology, S. Chand and Co., New Delhi.
2. Subba Rao. N.S. 1988. Biofertilizers in Agriculture, second Edition,Oxford & IBH Publishing Company Pvt. Ltd., New Delhi.
3. Lampin N. 1990. Organic Farming. Press Books, lpswitch, UK.
4. Palaniappan SP & Anandurai K. 1999. Organic Farming –Theory andPractice.Scientific Publications

Reference Books:

1. Subba Rao, N.S 1982. Advances in Agricultural Microbiology, Oxford & IBH PublishingCompany pvt. Ltd., New Delhi.
2. Venkatraman, G.S. 1972. AlgalBiofertilizer and Rice Cultivation, Today and Tomorrow printers and Publishers, New Delhi.

Course Designers:
Dr. K.Rajendran

Lecture Schedule

Unit	**Topic**	**Lecture hrs.**	**Method**
1.1	Biofertilizers: Introductionand scope. A general account of Biofertilizers organisms -Algae (BGA), Bacteria and Mycorrhizae..	6	Black Board
1.2	Mass cultivation of Azolla. Bactrria –Rhizobium and its mass production. Phosphate solubilizing bacterial biofertilizers –Pseudomonas and its mass multiplication	5	Power Point
1.3	Fungal biofertilizers –Mycorrhiza	4	Smart Board
2.1	Organic farming:Concept, definition and applications. Organic residues,soil biota and decomposition of organic residues,	5	Black Board
2.2	Organic manures, composting, vermicompost, green manures-production and application methods of organic manures.	6	Power Point
2.3	Marketing of organic products	4	Black Board
Total		**30**	

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Department of Botany

(For those joined B. Sc., Botany on or after June 2019)

Programme Code-UBO

Course Code	Course Title	Category	L	T	P	Credit
UBO19SE41(C)	**Bioremediation**	(Skill Enahncement Course - 1)	**2**	**-**	**-**	**2**

Year	Semester	Int. Marks	Ext.Marks	Total
Seond	Fourth	15	35	50

Preamble

To equip the students with the basic principles of histology and technical aspects of Staining Techniques

Course Outcomes

On completion of the course the student will be able to

#	Course Outcome	Knowledge Level (according to Bloom's Taxonomy)
CO1	Effects on environment- Pollution-recalcitrantcompounds and xenobiotics-radioactive wastes	K1
CO2	Bioremediation – types – factors affecting – mechanism of bioremediation – limitation- Phytoremediation.	K2
CO3	Bioremediation techniques- Bioleaching	K3
CO4	Bioremediation of xenobiotics- Bioremediation of hydrocarbons	K3

K1 - Knowledge K2 - Understand K3 - Apply

Mapping of Course Outcomes with Programme Specific Outcomes

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

S-Strong M-Medium L-Low

Blooms taxonomy: Assessment Pattern

	CA		End of Semester
	First	**Second**	
Knowledge	40%	40%	40%
Understand	40%	40%	40%
Apply	20%	20%	20%
Total	30	30	65

Unit I: Introduction to pollution - Pollutants-types–effects on environment-recalcitrantcompounds and xenobiotics-radioactive wastes. Bioremediation – types – factors affecting – mechanism of bioremediation – limitation –microbes involved in bioremediation – essential characters of microbes - Phytoremediation.

Unit II: Bioremediation techniques:*Insitu*methodsand*Exsitu*remediationmethods.Bioleaching – copper and gold. Bioremediation of xenobiotics – reductive degradation, oxidative degradation, hydrolysis. Bioremediation of hydrocarbons – bioremediation of heavy metals

Text books:

Rajendran, P. and P.Gunasekaran, 2006. Microbial bioremediation, MJP publishers, Chennai.
Dubey, R .C. 2002. A textbook of Biotechnology. S.Chand and Co. Ltd ., New Delhi.
Singh, B.D., 1998. Biotechnology. Kalyani publishers, New Delhi.

Reference books:

Gupta, P.K.1994. Elements of Biotechnology, Rastogi and Co., Meerut, India.
Dubey, R .C. 2000. A text book of Biotechnology, S.Chand and Co. Ltd., New Delhi.

Course designers
1. Dr. K. Jegathesan 2. Dr. M. Viji

Lecture Schedule

Unit	**Topic**	**Lecture hrs.**	**Method**
1.1	Introduction to pollution - Pollutants-types–effects on environment- recalcitrantcompounds and xenobiotics-radioactive wastes.	6	Black Board
1.2	Bioremediation – types – factors affecting – mechanism of bioremediation	5	Power Point
1.3	Essential characters of microbes - Phytoremediation.	4	Smart Board
2.1	Bioremediation techniques:*Insitu*methodsand*Exsitu*remediation methods.	3	Black Board
2.2	Bioleaching – copper and gold	2	Power Point
2.3	Bioremediation of xenobiotics – reductive degradation, oxidative degradation, hydrolysis	5	Black Board
2.4	Bioremediation of heavy metals	5	Power Point
Total		**30**	

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Department of Botany

(For those joined B. Sc., Botany on or after June 2019)

Programme Code-UBO

Course Code	Course Title	Category	L	T	P	Credit
UBO19C51	**Morphology and Taxonomy of Angiosperms**	**Core -7**	**4**	**-**	**-**	**4**

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

Preamble

Acquiring knowledge about types of plant parts,various system of classification and Identification of plants based on characters

Course Outcomes

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

#	Course Outcome	Knowledge Level (according to Bloom's Taxonomy)
CO1	Describe the Morphological variation and types of plant parts	K1
CO2	Collect, identify and preserve plants	K2
CO3	Characterize families in polypetalae	K2, K3
CO4	Characterize families in gamopetalae	K2, K3
CO5	Characterize families in monocot and monochlamydeae	K2, K3

K1 - Knowledge K2 - Understand K3 - Apply

Mapping of Course Outcomes with Programme Specific Outcomes

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

S-Strong M-Medium L-Low

Blooms taxonomy: Assessment Pattern

	CA		End of Semester
	First	Second	
Knowledge	30%	30%	30%
Understand	40%	40%	40%
Apply	30%	30%	30%
Total	52	52	140

Title of the paper Morphology and Taxonomy of Angiosperms

Unit I: Morphology – Modifications of tap root and fibrous root system – Modification of stem – aerial and underground stem – Modification of leaf; Inflorescence types – Racemose, Cymose, mixed and special types. Fruits – simple, aggregate and multiple fruits.

Unit II: Types of Nomenclature-Binomial Nomenclature, Herbarium technique – Principles of Classification – Bentham & Hooker – APG III (Outline only) - ICBN and its role, Botanical survey of India (BSI) - National herbarium– Regional Centers and their role.

Unit III: Study on the key features, vegetative and floral characters of the following families of Polypetalae and their economic importance
1.Magnoliaceae 2.Annonaceae3. Capparidaceae 4. Rutaceae 5. Caesalpiniaceae 6. Cucurbitaceae

Unit IV: Study on the key features, vegetative and floral characters of the following families of Gamopetalae and their economic importance
6. Sapotaceae 7. Convolvulaceae 8. Asclepiadaceae 9. Acanthaceae 10. Lamiaceae

Unit V: Study on the key features, vegetative and floral characters of the following families of Monochlamydeae and Monocotoyledons with their economic importance 11. Amaranthaceae 12. Euphorbiaceae 13. Amaryllidaceae 14. Poaceae 15. Cyperaceae

Text Books:
1. Venkateswarlu, V. 1982. External morphology of Angiosperms, S.Chand and Co.Ltd., New Delhi.
2.Narayanswami, R.V., K.N. Rao and A.Raman. 1992. Outlines of Botany, S.Viswanathan Printers and Publishers, Chennai.
3.Singh, V. and K.Jain. 1991. Taxonomy of Angiosperms, Rastogi Publications, Meerut.
4.Vasishta, P.C.1992. Taxonomy of Angiosperms, R.Chand and Co. Ltd., New Delhi.
5.Lawrence, G.H.M. 1951. Taxonomy of Vascular plants. The Mac-Millan Co., New York.
6.Heywood, V.K. 1967. Plant Taxonomy Edward Arnold Pub. Ltd., London.

Reference Books:
1.Sharma, O.P. 2009. Plant Taxonomy, Tata McGraw-Hill publishers, New Delhi.
2.Pulliah, T. 2007. Taxonomy of Angiosperms, Third Edition, Regency Publication, New Delhi.
3.Tod, F. Stueesy, 2009. Plant Taxonomy; the systematic evaluation of comparative data. Colambia Uni. Press. NewYork.
4.Stace, C.A. 1980. Plant Taxonomy and Biosystematics, Edward Arnold Publishing Limited, London.874

Course designers
1. Dr.K.Rajendran
2. Dr. R.Aruna

Lecture Schedule

	Topic	No of lecture hrs.	Method
1	Modifications root, stem	5	Black board
2	Modifications of flowers and fruits	6	Black board
3	Classification of Plants - Bentham & Hooker – APG III	5	PPT, Individual summarising
4	Nomenclature – Rules and recommendations of ICBN	6	PPT, Group discussion
5	Herbarium technique, BSI – regional centers and their role	8	Black board, PPT,
6	key features, vegetative and floral characters of Annonaceae, Capparidaceae, Rutaceae	6	PPT, live model description
7	key features, vegetative and floral characters of Caesalpiniaceae, Cucurbitaceae, Magnoliaceae	4	PPT, live model description
8	key features, vegetative and floral characters of Sapotaceae, Convolvulaceae, Asclepiadaceae,Acanthaceae, Lamiaceae	10	PPT, live model description
9	key features, vegetative and floral characters of Amaranthaceae, Euphorbiaceae, Amaryllidaceae, Poaceae, Cyperaceae	10	PPT, live model description
Total		60	

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Programme Code-UBO

Course Code	Course Title	Category	L	T	P	Credit
UBO19CL51	**Morphology and Taxonomy of Angiosperms Lab**	**Core lab - 5**	**-**	**-**	**4**	**2**

Year	Semester	Int. Marks	Ext.Marks	Total
Third	Fifth	40	60	100

Preamble

To able to identify plants based on characters and method of preservation

Course Outcomes

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

#	Course Outcome	Knowledge Level (according to Bloom's Taxonomy)
CO1	Explain the Morphological variation and types of plant parts	K1
CO2	Collect, identify and preserve plants	K2
CO3	Characterize and Identify families in polypetalae	K2, K3
CO4	Characterize and Identify families in gamopetalae	K2, K3
CO5	Characterize and Identify families in monocot and monochlamydeae	K2, K3

K1 - Knowledge K2 - Understand K3 - Apply

Mapping of Course Outcomes with Programme Specific Outcomes

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

S-Strong M-Medium L-Low

1. Root, Stem and leaf modification of Angiosperms
2. Study on the morphological and floral characters of the following families
Magnoliaceae,Annonaceae, Capparidaceae, Rutaceae, Caesalpiniaceae, Cucurbitaceae Sapotaceae, Convolvulaceae, AsclepiadaceaeAcanthaceae, Lamiaceae Amaranthaceae, Euphorbiaceae, Amaryllidaceae, Poaceae, Cyperaceae
3. Herbarium preparation

Course designers
1. Dr. K.Rajendran
2. Dr. R.Aruna

Thiagarajar College (Autonomous): Madurai – 625 009

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Programme Code-UBO

Course Code	**Course Title**	**Category**	**L**	**T**	**P**	**Credit**
UBO19C52	BIOCHEMISTRY	Core-8	4	-	-	4

Year	**Semester**	**Int. Marks**	**Ext.Marks**	**Total**
Third	Fifth	25	75	100

Preamble

Imparting the knowledge to the students in the subject of various categories of biochemical substances and their unique properties and functions, pertinent to plants

Course Outcomes

On completion of the course the student will be able to

#	Course Outcome	Knowledge Level (according to Bloom's Taxonomy)
CO1	Describe the categories of bio-molecules	K1
CO2	Reveal the structure, properties and functions of bio-molecules	K2
CO3	Depict the metabolism of amino acids and lipids	K2
CO4	Explain the categories of enzymes and mechanism of their activity	K2
CO5	Reason out the different nature of secondary metabolites and their properties and specific functions in plants	K3

K1 - Knowledge K2 - Understand K3 - Apply

Mapping of Course Outcomes with Programme Specific Outcomes

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

S-Strong M-Medium L-Low

Blooms taxonomy: Assessment Pattern

	CA		**End of Semester**
	First	**Second**	
Knowledge	40%	40%	40%
Understand	40%	40%	40%
Apply	20%	20%	20%
Total	52	52	140

Unit I: Biochemistry - Scope and application in the various fields - Biomolecules- Definition and classification – Primary and secondary metabolites –distinct properties. Primary Metabolites – Carbohydrates: Classification- Mono, di, tri and polysaccharides: Structure; properties and functional role. Amino acids – Classification – Essential and Non-Essential types and properties, functional role in plants.

Unit II: Proteins – phases of protein synthesis and termination process (Brief account) – Structural details – Primary, secondary, tertiary and quaternary structures – Physical and Biochemical properties and functional role in plants. Pigments: structure of chlorophyll, carotenoids, phycobilins and anthocyanin. Lipids – Classification — saturated and unsaturated fatty acids – Properties

Unit III: Enzymes -classification – Basis of source and substrate and nature of Biochemical activity- IUB system of Nomenclature - physico-chemical properties – mechanism of enzyme action-Theories: Lock and key and induced-fit models; Physical and Chemical factors affecting enzyme action; Enzyme regulators – Activating factors – Enzyme Inhibitors – Competitive and Non-cooperative, Feedback and allosteric.

Unit IV: Vitamins – classification – water and fat soluble vitamins – dietary sources and vitamin deficiencies – vitamins with coenzyme function. Secondary Metabolites – Classification; Alkaloids, Glycosides, Steroids, Terpenoids, Phenols – General structure, properties andfunctions

Unit V: Secondary Metabolites – Major synthetic pathways – Shikimic acid pathway, Mevalonate pathway and tryptophan pathway; storage functions of hydrophobic and hydrophilic secondary metabolites

Text Books:

Satyanarayana, U. and U. Chakrapani, 2013. Biochemistry. Elsevier Co-published with Books and Allied Press, New Delhi

2. Lea, P.J and Leegood, R.C. 2001. Plant Biochemistry and Molecular Biology, 2nd Ed. John Wiley and Sons Ltd., England.

3. Jain, J. L. 2000. Fundamentals of Biochemistry. S. Chand & Co. Ltd., New Delhi.

Reference Books:

1. James Bonner, J. E. Varner, 2016. ‘Plant Biochemistry’, Elsevier Publishers, Netherlands, UK.

2. A. L. Lehninger, A.L. 2013. ‘Biochemistry’, Freeman, W.H. and Company, New York, USA.

3. Gleason, J.K. and Chollet,, R.2012. ‘Plant Biochemistry’, Jones and Barlett Publishers, London

4. Stryer, L. 2010. ‘Biochemistry’ – VI Edition, Freeman W.H. and Company, New York, USA

Course Designer: Dr. D. Kannan

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Course Code	**Course Title**	**Category**	**L**	**T**	**P**	**Credit**
UBO19CL52	BIOCHEMISTRY LAB	Core Lab-6		-	4	2

Year	**Semester**	**Int. Marks**	**Ext.Marks**	**Total**
Third	Fifth	40	60	100

Preamble

Provision of practical knowledge in the analytical techniques in the field of plant biochemistry, using laboratory analytical methods and instrumentations

Course outcome

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

#	Course Outcome	Knowledge Level (according to Bloom's Taxonomy)
CO1	Distinguish biomolecules on the basis of the structural orientation	K1
CO2	Undertake wet chemical analysis by adopting titration	K3
CO3	Quantify biomolecules using gravimetric and colorimetric principles	K3
CO4	Qualitatively identify biomolecules by elimination procedure	K4
CO5	Operate, calibrate and handling the equipments, viz., pH meter, colorimeter, centrifuge	K5

K1 - Knowledge K2 - Understand K3 - Apply

Mapping of Course Outcomes with Programme Specific Outcomes

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

S-Strong M-Medium L-Low

1. Qualitative tests for simple sugars, starch, Amino acid, protein and cholesterol
2. Quantitative estimation of sugars through wet-chemistry
3. Quantitative estimation of starch by gravimetric method
4. Quantitative estimation of amino acids through wet-chemistry
5. Quantitative estimation of proteins through wet-chemistry
6. Quantitative estimation of Fatty acid through gravimetric method
7. Phosphate Buffer / citrate buffer preparation using titration method
8. Pigment extraction and separation through paper chromatography technique
9. Saponification value of fat
10. pH measurement using pH meter
11. Complementary colour determination using colorimeter
12. Gel electrophoretic separation of leaf protein (Demonstration only)

Course Designer: Dr. D. Kannan

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Course Code	Course Title	Category	L	T	P	Credit
UBO19C53	Genetics, evolution and biostatistics	Core-9	3	-	-	4

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

Preamble

To equip the students with the basic principles of Genetics, evolution and biostatistics.

Course Outcomes

On completion of the course the student will be able to

#	Course Outcome	Knowledge Level (according to Bloom's Taxonomy)
CO1	Know about Mendel's Law on heredity	K1
CO2	Concept learning of Linkage and crossing over	K2
CO3	Realize Sex determination in plants	K1
CO4	Recognize Evolution studies	K2
CO5	Determine the concepts of biostatistics	K3

K1 - Knowledge K2 - Understand K3 - Apply

Mapping of Course Outcomes with Programme Specific Outcomes

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

S-Strong M-Medium L-Low

Blooms taxonomy: Assessment Pattern

	CA		End of Semester
	First	**Second**	
Knowledge	40%	40%	40%
Understand	40%	40%	40%
Apply	20%	20%	20%
Total	52	52	140

Unit I: Mendel's law on heredity –Terminologies–Monohybrid cross–Law of dominanceand Law of segregation – Incomplete Dominance in *Mirabilis jalapa* – Reciprocal cross, Back cross and Test cross – Method and significance; Dihybrid cross – *Pisumsativum* – Law of Independent Assortment; Modifications of Mendelian ratios – Duplicatory genes, Supplementary genes and Dominant Epistatis.

Unit II: Linkage– Morgan's Principle –Types–Complete (*Drosophila*) and incomplete(*Zea mays*); Crossing over – Mechanism in *Drosophila* and maize – Coupling and Repulsion Reciprocal crossing in *Lathyrusodoratus* – Theories – Chiasma type – breakage first – differential contraction – Limiting factors of crossing over – significance; Polygeneic inheritance – Kernalcolour in Wheat – Quantitative inheritance.

Unit III: Sex determination - Mechanism in*Melandrium album*; Sex linked inheritance–Eye colour in *Drosophila*, Haemophilia: Extra chromosomal inheritance – Plastid inheritance in *Mirabilis jalapa*–Uniparental inheritance in *Chlamydomonasreinharditi* ; Chromosomal variations – Euploidy and aneuploidy; Chromosomal aberrations – mechanism and significance of the following categories – Duplication, deletion, inversion and translocation.

Unit IV: Evolution: Morphological, anatomical and physiological evidences for evolution. Lamarck's theory; inheritance of acquired characters; Darwin's theory of natural selection; Mutation theory of Hugo de Vries; Modern Synthetic theory – Genetic drift.

Unit V: Biostatistics–Data–Definition–Data classification; Presentation of data–Tableforms – Chart forms – Scatter points, line, bar, histogram, pie; descriptive statistics – Mean, Mode, Median, Standard Deviation (Direct method only) – problem and solving method, Chi-square test – Applications in Genetics and breeding experiments.

Text Books:

Archunan. 2004. Genetics, Sarup& Sons, New Delhi.

Shukla, R.N. 2009. A Text Book of Genetics and Evolution, Daya Publishing House, New Delhi.

Arora, M.P. Arora, H. 2013, A Text Book of Organic Evolution, Daya Publishing House, New Delhi.

Sharma, A.K.2005. Text Book of Biostatistics, Discovery Publishing House, New Delhi.

Reference Books:

Ringo, J. 2004. Fundamental Genetics, Cambridge University Press.

Barton, N.H. 2007. Evolution, Cold Spring Harbor Laboratory Press, New York.

Ridley, M.2009. Evolution, John Wiley Sons, USA.

Zar, J.H. 2010. Biostatisticial Analysis, Prantice – Hall Inc.

Course Designer:

Dr.E.Mohan

Lecture Schedule

Unit	Topic	Lecture hrs.	Method
1.1	Mendel's law on heredity – Terminologies – Monohybrid cross	2	Black Board
1.2	Law of dominance and Law of segregation – Incomplete Dominance in Mirabilis jalapa –	2	Power Point
1.3	Reciprocal cross, Back cross and Test cross – Method and significance;	2	Smart Board
1.4	Dihybrid cross – Pisumsativum – Law of Independent Assortment;	2	Black Board
1.5	Modifications of Mendelian ratios – Duplicatory genes, Supplementary genes and Dominant Epistatis.	2	Power Point
2.1	Linkage – Morgan's Principle – Types – Complete (Drosophila) and incomplete (Zea mays);	3	Black Board
2.2	Crossing over – Mechanism in Drosophila and maize – Coupling and Repulsion – Reciprocal crossing in Lathyrusodoratus –	3	Power Point
2.3	Theories – Chiasma type – breakage first – differential contraction – Limiting factors of crossing over – significance; Polygeneic inheritance – Kernalcolour in Wheat – Quantitative inheritance.	3	Group Discussion
3.1	Sex determination - Mechanism in Melandrium album; Sex linked inheritance – Eye colour in Drosophila, Haemophilia:	3	Video lecture
3.2	Extra chromosomal inheritance – Plastid inheritance in Mirabilis jalapa – Uniparental inheritance in Chlamydomonasreinharditi	3	Power Point
3.3	Chromosomal variations – Euploidy and aneuploidy; Chromosomal aberrations – mechanism and significance of Duplication, deletion, inversion and translocation.	3	Power Point
4.1	Evolution: Morphological, anatomical and physiological evidences for evolution.	3	Peer group Learning
4.2	Lamarck's theory; inheritance of acquired characters; Darwin's theory of natural selection;	3	Black Board
4.3	Mutation theory of Hugo de Vries; Modern Synthetic theory – Genetic drift.	2	Black Board
5.1	Biostatistics – Data – Definition – Data classification; Presentation of data –	3	Power point presentation
5.2	Table forms – Chart forms – Scatter points, line, bar, histogram, pie; descriptive statistics	3	Black Board
5.3	Mean, Mode, Median, Standard Deviation (Direct method only) – problem and solving method, Chi-square test – Applications in Genetics and breeding experiments	3	Black Board
Total		**45**	

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Course Code	Course Title	Category	L	T	P	Credit
UBO19CL53	Genetics, evolution and biostatistics	Core Lab -7		-	2	1

Year	Semester	Int. Marks	Ext.Marks	Total
Third	Fifth	40	60	100

Preamble

To equip the students with the basic principles of Genetics, evolution and biostatistics.

Course Outcomes

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

#	Course Outcome	Knowledge Level (according to Bloom's Taxonomy)
CO1	Know about Mendel's Law on heredity	K1
CO2	Concept learning of Linkage and crossing over	K2
CO3	Realize Sex determination in plants	K1
CO4	Recognize Evolution studies	K2
CO5	Determine the concepts of biostatistics	K3

K1 - Knowledge K2 - Understand K3 - Apply

Mapping of Course Outcomes with Programme Specific Outcomes

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

S-Strong M-Medium L-Low

I Problems solving in the following topics:

1 .Mendelian Monohybrid ratio
2 .MendelianDihybrid ratio
3 . Monohybrid reciprocal cross, back cross and test cross
4 . Gene Interaction – Duplicatory genes, Supplementary genes, Dominant epistatisis, Recessiveepistatsis

II Evolution and Biostatistics experiments

1 . Natural Selection using beads
2 . Genetic drift using beads
3 . Chi - square test using beads to demonstrate population genetics
4 . Descriptive statistics – Mean, Mode and Median, calculation for leaf length of randomly selected
Polyalthia leaves (or) Albizzia pods

III Models/Spotters – Relevant to theory topics

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Course Code	Course Title	Category	L	T	P	Credit
UBO19CE51(H)	**Horticulture and Plant Breeding**	**Core-Elective -1**	**5**	**-**	**-**	**5**

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

Preamble
To train the students with the basic knowledge of horticulture and plant breeding

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

#	Course Outcome	Knowledge Level (according to Bloom's Taxonomy)
CO1	Know about horticulture importance	K1
CO2	Comprehend the various propagation techniques	K2
CO3	Explore about the ornamental gardens	K2
CO4	Recognize the floral arrangement methods	K3
CO5	Determine the concepts of plant breeding	K3

K1 - Knowledge K2 - Understand K3 - Apply

Mapping of Course Outcomes with Programme Specific Outcomes

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

S-Strong M-Medium L-Low

Blooms taxonomy: Assessment Pattern

	CA		End of Semester
	First	**Second**	
Knowledge	40%	40%	40%
Understand	40%	40%	40%
Apply	20%	20%	20%
Total	52	52	140

Unit I: Importance of horticulture–Classification of horticultural crops–Gardenimplements – Nursery - Transplanting – Pruning and Training – Irrigation methods – Manure: Types and application.

Unit II: Propagation techniques: Separation or division–Cutting: Root, stem and leaf cutting–Layering: Ground and air layering –Budding - Grafting: Detached scion grafting – Approach grafting – Repair grafting – Budding.

Unit III: Ornamental garden and its components: Climbers and Creepers–Trees–Shrubs–Rock garden – Water garden – Hedges and Edges – Lawn – Flower beds – Path – Indoor garden: Choice of plants and maintenance – Bottle garden – Hanging pots – Bonsai – Kitchen garden: layout and choice of plants – Terrace Gardening

Unit IV: Flower arrangement: methods and different designs–colour scheme, Ikebana–Dryflower preparation: Techniques and arrangement – Greeting card making – Processing of horticultural crop products – Jam – Jelly – Squash – Tomato Ketchup – Citrus pickle.

Unit V: Plant Breeding: Plant introduction–Procedure of plant introduction. Selection:mass, clonal, pure line - Hybridization – procedure – intergeneric, interspecific and intervarietal hybridization with examples – Heterosis in plant breeding.

Text Books:

Chandha, K.L.2001. Hand book of Horticulture, New Delhi.
Rao, K.M. 1991. Text Book of horticulture, Mac Millan India Ltd, New Delhi.
Vishnu Swarup, 1999. Ornamental horticulture, Mac Millan India Ltd, New Delhi.
Sadhu, M.K.1996. Plant propagation. New age international publisher, New Delhi.

Sinha, V and Suintasinha, 1990. Cytogenetics, Plant breeding and Evolution, Vikas publishing Home Pvt Ltd.
Adariana, F.R.W. and Brison. 1979. Propagation of Horticultural crops. Tata McGraw-Hill Publishing Company Ltd, New Delhi.
Acquaah, G. 1999. Horticulture, Principles and Practices, Prentice Hall, New Jersey.
Prasad and Kumar, U.2005. Commercial Floriculture. Agrobios (India), Jodhpur.

Pohelman, J.M and Borthakur, D.1969. Breeding Asian field crops, Oxford and IBH publishing Co, New Delhi.

Course Designer:
Dr.E.Mohan

Lecture Schedule

Unit	Topic	Lecture hrs.	Method
1.1	Importance of horticulture – Classification of horticultural crops –	3	Black Board
1.2	Garden implements – Nursery - Transplanting –	3	Power Point
1.3	Pruning and Training –.	3	Smart Board
1.4	Irrigation methods –	3	Black Board
1.5	Manure: Types and application	3	Power Point
2.1	Propagation techniques: Separation or division.	5	Black Board
2.2	Cutting: Root, stem and leaf cutting – Layering: Ground and air layering –Budding -	5	Power Point
2.3	Grafting: Detached scion grafting – Approach grafting – Repair grafting – Budding	5	Group Discussion
3.1	Ornamental garden and its components: Climbers and Creepers – Trees	5	Video lecture
3.2	Shrubs – Rock garden – Water garden – Hedges and Edges – Lawn – Flower beds – Path – Indoor garden: Choice of plants and maintenance	5	Power Point
3.3	Bottle garden – Hanging pots – Bonsai – Kitchen garden: layout and choice of plants – Terrace Gardening	5	Power Point
4.1	Flower arrangement: methods and different designs – colour scheme, Ikebana –	5	Peer group Learning
4.2	Dry flower preparation: Techniques and arrangement – Greeting card making –	5	Black Board
4.3	Processing of horticultural crop products – Jam – Jelly – Squash – Tomato Ketchup – Citrus pickle.	5	Black Board
5.1	Plant Breeding: Plant introduction – Procedure of plant introduction.	5	Power point presentation
5.2	Selection: mass, clonal, pure line - Hybridization – procedure – intergeneric.	5	Black Board
5.3	interspecific and intervarietal hybridization with examples – Heterosis in plant breeding	5	Black Board
Total		**75**	

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Course Code	Course Title	Category	L	T	P	Credit
UBO19CE51(P)	Plant Resources and Utilization(Core Elective)	**Core elective - 1**	**5**	**-**	**-**	**5**

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

Preamble

To equip the students with the basic ideas of various economically important groups of plants , Study the morphology and useful parts commonly used plants

Course Outcomes

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

#	Course Outcome	Knowledge Level (according to Bloom's Taxonomy)
CO1	Basic knowledge about the plant resources and its uses	K1,K2
CO2	Economic importance of economically important plants like food plants, spices, beverages	K1, K2
CO3	Economic importance of economically important plants like fibre, wood and cork, dye and resins	K1, K2
CO4	Economic importance of economically important plants like plantation crops and medicinal plants	K1,K2
CO5	Economic importance of economically important plants like oil yielding plants, organic manure	K1,K2,K3

K1 - Knowledge K2 - Understand K3 - Apply

Mapping of Course Outcomes with Programme Specific Outcomes

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

S-Strong M-Medium L-Low

Blooms taxonomy: Assessment Pattern

	CA		End of Semester
	First	Second	
Knowledge	40%	40%	40%
Understand	40%	40%	40%
Apply	20%	20%	20%
Total	52	52	140

Unit I: Introduction to Plant resources – Classification of economically important plants: Food plants, Plants and plant products of commercial value, Medicinal plants, Food Adjuncts – Spices and condiments. Economic importance of lower group of plants: Food, medicinal, industrial and ornamental uses of Algae, Fungi, Lichens.

Unit II:Botanical names, Morphology, useful parts and uses of the following: Food plants: *Oryza sativa* (Rice), *Triticumaestivum* (Wheat), *Vignamungo* (Black gram), *Glycine max* (Soybean), *Prunisdulcis* (Almonds), *Cocosnucifera* (Coconut), *Manihotesculenta* (Tapioca), *Solanumtuberosum* (Potato), *Brassica oleracea* (Cabbage), *Solanumlycopersicum* (Tomato), *Mangiferaindica* (Mango) and *Musa paradisiaca* (Banana) Beverages: *Coffeaarabica* (Coffee) and *Camellia sinensis* (Tea) Spices and Condiments: *Zingiberofficinale* (Ginger) and *Cuminumcyminum* (Cumin)

Unit III: Botanical names,Morphology, useful parts and uses of the following: Fibre and fibre yielding plants: *Gossypiumhirsutum* (Cotton) and *Corchoruscapsularis* (Jute), *Musa textilis* (Abaca Manila Hemp). Wood and Cork: *Dalbergialatifolia* (Rose wood), *Tectonagrandis* (Teak) and *Quercussuber* (Cork oak). Morphology, useful parts and uses of the following: Tannin and Dye yielding plants: *Albizzialebbeck* (Vagai), *Cassia alata* (SeemaiAgathi), *Acacia leucocephloea* (Sarai) and *Lawsoniainermis* (Maruthani) Gums and Resins*: Acacia senegal* (Suddaykeeray), *Moringaoleifera* (Murungai), *Shorearobusta* (Sal) and *Pinusroxburghii* (Chir), Lac and shellac.

Unit IV: Botanical names,Morphology, useful parts and uses of the following: Plantation crops: *Casuarinaequisetifolia* (Sea oak) and *Hevea brasiliensis* (Rubber). Medicinal Plants: *Allium cepa* (Onion), *Cinnamomumzeylanicum* (Cinnamon), *Ocimumtenuiflorum* (Holy Basil), *Piper nigrum* (Pepper), *Curcuma longa*, (Turmeric) and *Azadirachtaindica* (Neem).

Unit V: Botanical names,Morphology, useful parts and uses of the following: Oil yielding plants: *Helianthus annus* (Sunflower), *Sesamumindicum* (Sesame*), Ricinuscommunis* (Castor), *Borassusflabellifer* (Palm) and *Eucalyptus globulus* (Eucalyptus). Organic manure – Types: Agriculture waste compost, Coir pith compost, Mushroom spent compost, Green manure, Bagasse and molasses.

Text Books:
1.Sambamurthy, A.V.S.S. and N.S. Subramanyam, 1989. A Text Book of Economic Botany, Wiley-Eastern Ltd, New Delhi.
2.Pandey, B.P. 2012. Economic Botany, S.Chand& Company Ltd, New Delhi.

Reference Books:
1.Kochhar, S.L. 1995. Economic Botany in the Tropics, Macmillan India Ltd., Delhi.
2.Sharma, O.P. 1996. Hill's Economic Botany, Tata McGraw Hill Co. Ltd., New Delhi.
3.Peter B. Kaufman et al., 1999. Natural Products from Plants, Second Edition, Google ebook. http://trove.nla.gov.au/version/46518552

Course Designer:
Dr.R.Aruna

Lecture Schedule

Unit	Topic	Lecture hrs	Method
1.1	Introduction to Plant resources	3	PPT
1.2	Classification of economically important plants	3	PPT
1.3	Food plants, Plants and plant products of commercial value, Medicinal plants	3	PPT
1.4	Food Adjuncts – Spices and condiments.	3	PPT
1.5	Economic importance of lower group of plants: Food, medicinal, industrial and ornamental uses of Algae, Fungi, Lichens	3	PPT
2.1	Botanical names, Morphology, useful parts and uses of Food plants: *Oryza sativa* (Rice), *Triticum aestivum* (Wheat), *Vigna mungo* (Black gram), *Glycine max* (Soybean),)	5	PPT
2.2	*Prunis dulcis* (Almonds), *Cocos nucifera* (Coconut), *Manihot esculenta* (Tapioca), *Solanum tuberosum* (Potato), *Brassica oleracea* (Cabbage), *Solanum lycopersicum* (Tomato), *Mangifera indica* (Mango) and *Musa paradisiaca* (Banana)	5	Black Board
2.3	Beverages: *Coffea arabica* (Coffee) and *Camellia sinensis* (Tea) Spices and Condiments: *Zingiber officinale* (Ginger) and *Cuminum cyminum* (Cumin)	5	Black Board
3.1	Fibre and fibre yielding plants: *Gossypium hirsutum* (Cotton) and *Corchorus capsularis* (Jute), *Musa textilis* (Abaca Manila Hemp).	5	PPT
3.2	Botanical names, Morphology, useful parts and uses of the following: Wood and Cork: *Dalbergia latifolia* (Rose wood), *Tectona grandis* (Teak) and *Quercus suber* (Cork oak). Morphology, useful parts and uses of the following: Tannin and Dye yielding plants: *Albizzia lebbeck* (Vagai), *Cassia alata* (SeemaiAgathi), *Acacia leucocephloea* (Sarai) and *Lawsonia inermis* (Maruthani)	5	PPT
3.3	Botanical names, Morphology, useful parts and uses of Gums and Resins*: Acacia senegal* (Suddaykeeray), *Moringa oleifera* (Murungai), *Shorea robusta* (Sal) and *Pinus roxburghii* (Chir), Lac and shellac.	5	PPT
4.1	Botanical names, Morphology, useful parts and uses of Plantation crops: *Casuarina equisetifolia* (Sea oak) and *Hevea brasiliensis* (Rubber).	5	PPT
4.2	Botanical names, Morphology, useful parts and uses of the following: Medicinal Plants: *Allium cepa* (Onion), *Cinnamomum zeylanicum* (Cinnamon), *Ocimum tenuiflorum* (Holy Basil)	5	PPT
4.3	Botanical names, Morphology, useful parts and uses of *Piper nigrum* (Pepper), *Curcuma longa*, (Turmeric) and *Azadirachta indica* (Neem).	5	Black Board
5.1	*Helianthus annus* (Sunflower), *Sesamum indicum* (Sesame)	5	PPT
5.2	*Ricinus communis* (Castor), *Borassus flabellifer* (Palm) and *Eucalyptus globulus* (Eucalyptus).	5	Black Board
5.3	Organic manure – Types: Agriculture waste compost, Coir pith compost, Mushroom spent compost, Green manure, Bagasse and molasses.	5	Black Board
Total		**75**	

Thiagarajar College (Autonomous): Madurai – 625 009

Department of Botany

(For those joined B. Sc., Botany on or after June 2019)

Programme Code-UBO

Course Code	Course Title	Category	L	T	P	Credit
UBO19NE51	Botanical World	NME 2	2	-	-	2

Year	Semester	Int. Marks	Ext.Marks	Total
Third	Fifth	15	35	50

Preamble

To give the overview of various branches of Botany and significance of plants

Course Outcomes

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

#	Course Outcome	Knowledge Level (according to Bloom's Taxonomy)
CO1	Recognize various branches of Botany	K1
CO2	Realize the significance of plants	K2
CO3	Reveal plant animal interaction	K2
CO4	Analyze the values of plants	K3

K1 - Knowledge K2 - Understand K3 – Apply

Mapping of Course Outcomes with Programme Specific Outcomes

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

S-Strong M-Medium L-Low

Blooms taxonomy: Assessment Pattern

	CA		End of Semester
	First	Second	
Knowledge	40%	40%	40%
Understand	40%	40%	40%
Apply	20%	20%	20%
Total	30	30	65

Unit I: Plant Science: History- Milestones in Botany. Branches of Botany: Phycology, mycology, bryology, embryology, anatomy, cytology, taxonomy, genetics, paleo botany, agriculture, horticulture, plant breeding, tissue culture (Brief Description with importance)

Unit II: Plant Animal interaction: Symbiosis, Myrmecophily, lac insect, Pollination mechanism and honey. Plants as: Food makers (primary producers), Scavengers (decomposers), Purifiers (air, water), Industrialists (antibiotics, vaccines, vitamins, beverages, biofertilizers). Medicine (Tulsi, Pepper, Ginger, Eucalyptus, Kilanelli and Turmeric). Plants of the Past: Fossil fuels.

Text Books:

1. G. Brum, L. Mc Kane and G. Karp. 1995. Biology Fundamentals, John Wiley & Sons, Inc., Canada.,
2. D. K. Northington and E. L. Schneider. 1996. The Botanical World, Wm. C. Brown Publishers,
3. B. Stadler and T. Dixon, 2008. Mutualism: Ants and their insect partners, Cambridge: Cambridge University Press,

Reference Books:

1. Charles Darwin, 1908. Insectivorous Plants, London.
2. John Murray. Hendry N. Andrews, JR. 1961. Studies in Paleobotany, John Wiley &Sons INC, New York, London.
3. Attenborough, David, *The Private Life of Plants*, ISBN 0-563-37023-8
4. Bellamy, David, *Bellamy on Botany*, ISBN 0-563-10666-2 - An accessible and short introduction to various botanical subjects

Course designer

1. Dr. K.Saraswathi

Lecture Schedule

	Topic	No of lecture hrs.	Method
1.1	Milestones in Botany	3	Black Board, PPT
1.2	Phycology, Mycology, Bryology	2	Black Board, PPT
1.3	Embryology, Anatomy,Cytology	2	Black Board, PPT
1.4	Taxonomy, Genetics, Palaeobotany	2	Black Board, PPT
1.5	Agriculture, Horticulture, Plant Breeding, Tissue Culture	3	Black Board, PPT
1.6	Symbiosis, Myrmecophily	3	PPT
2.1	Lac insect, Pollination mechanism and honey	3	PPT
2.2	Primary producers, Decomposers	3	PPT
2.3	Purifiers, Industrialists	3	Black Board
2.4	Medicines	3	Specimens and Black Board
2.5	Fossil fuels	3	PPT
	TOTAL	**30**	

Thiagarajar College (Autonomous): Madurai – 625 009
Department of Botany
(For those joined B. Sc., Botany on or after June 2019)
Programme Code-UBO

Course Code	Course Title	Category	L	T	P	Credit
UBO19C61	**Plant Physiology**	**Core- 10**	**4**	**-**	**-**	**4**

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

Preamble
Imparting the knowledge to the students in the subject of various categories of Plant Physiology, which controls the growth functions in plants

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

#	Course Outcome	Knowledge Level (according to Bloom's Taxonomy)
CO1	Explain the functional approach of plants with relation to water status in plants through uptake and transpiration	K1
CO2	Reveal the plant nutrition which controls the plant growth, indicates through deficiency; nutrient uptake process	K2
CO3	Depict the basic aspects of photo biology and its relevance to photosynthetic function	K2
CO4	Explain the plant respiratory metabolism of plant cell and its significance	K2
CO5	Reason out the different nature of physiological activity of plant growth substances, flowering, fruit ripening	K3

K1 - Knowledge K2 - Understand K3 - Apply

Mapping of Course Outcomes with Programme Specific Outcomes

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

S-Strong M-Medium L-Low

Blooms taxonomy: Assessment Pattern			
	CA		End of Semester
	First	Second	
Knowledge	40%	40%	40%
Understand	40%	40%	40%
Apply	20%	20%	20%
Total	52	52	140

Unit I: Water relations in plants: Water – Physical and Chemical properties – Physiological role in plants, Water potential: Definition, components- Osmotic and pressure potential; Water absorption mechanism - Imbibition, Diffusion and Osmosis –Ascent of sap: Definition – Theories – Physical-force and vital; Transpiration – Definition and Types; Stomatal organization and movement – physiological mechanism: Starch-sugar hypothesis, active K^+ transport – Guttation through hydathodes – Transpiration advantages to plants' environment (12 Hours)

Unit II: Mineral Nutrition in plants - Categories – Essential and Non-essential, Major and minor elements: Physiological role and nutrient deficiency symptoms in plants – Passive Absorption and Active Absorption – Theories – Carrier concept, ion channels, ATPase pump – Solute Translocation: Definition- Evidences showing translocation through phloem; Protoplasmic streaming and Münch's Pressure flow theories. (12 Hours)

Unit III: Photosynthesis: Photobiology – Action and Absorption spectrum – Quantum yield – Complementary colour in relation to photosynthesis – Emerson's red drop and Light intensity enhancement phenomena - Molecular organization of Chloroplast in higher plants – Photosynthetic unit organization –Photochemical Reaction – Organization of PS-I and PS-II - Photophosphorylation – 'Z' scheme- Cyclic and Non-cyclic; Dark Reaction - Calvin & Benson (C3) cycle- C4 cycle and CAM pathway – Overall mechanism of photorespiration (C2 cycle) and its significance (12 Hours)

Unit IV: Respiratory Metabolism – Respiratory quotient (RQ) Aerobic respiration – Glycolysis – TCA cycle – Oxidative Phosporylation – Pentose Phosphate Pathway and glyoxylate cycle. Anaerobic respiration – Fermentation reaction (brief account only) Factors affecting respiration- gluconeogenesis; Nitrogen metabolism – Nitrogen availability sources to plants- N_2 fixation - Environmental, Biological nitrogen fixation – Free-living, symbiotic organisms and processes (Brief account only) – Nitrogen cycle – Assimilation, utilization and release by plants (12 Hours)

Unit V: PlantGrowth Regulators – auxins, gibberellins, cytokinins, abscissic acid and ethylene-geneal structure and physiological role in plants. Photomorphogenesis: Concept, photoreceptors – phytochrome – types and physiological role in flowering- Fruit ripening-mechanism – ripening enhancement methods; Seed dormancy –definition, causal factors – physiological and methods of breaking seed dormancy- mechanism of seed germination;Vernalization: Definition, mechanism and significance. Nicky-nasty plant movements – Phototropism, thigmotrophism and diurnal plant movements (12 Hours)

Text Books:

1. Das, S. and Bharadwaj, A.B. 'Plant Physiology', Wisdom Press, New Delhi
2. Gupta, N. K. and S. Gupta. 2005. 'Plant Physiology', Oxford & IBH publishing Co. Ltd., New Delhi
3. Dutta, K. 'Plant Physiology', 2000. Narosa Publishers, New Delhi.

4. Noggle, G. R. and G. J. Fritz. Introductory Plant Physiology, Second Edition, Prentice-Hall of India Ltd., New Delhi.
5. Srivastava, L.M. 2010. 'Plant Growth and Development: Hormones and Environment', Academic Press, California.
6. Verma, S. K. A Text Book of Plant Physiology and Biochemistry, Fourth Edition, ISBN: 81-219-0627-X

Reference Books:

1. Tazia, L. and Zeiger, E. '2010. 'Plant Physiology', V Edition, The Benjamin and Cummings Publishers, California
2. Hopkins, W.G. and Hunter, N.P.A. 2009. 'Introduction to Plant Physiology', IV Edition, Wiley, New York.
3. Salisbury, F. B. and Ross, C. W. 1992. 'Plant Physiology', Asia Ltd., Singapore.
4. Devlin, R. M. and Witham, F.H.1986. 'Plant Physiology', Fourth Edition, CBS Pub., Delhi.

Syllabus prepared by: Dr. D. Kannan

Lecture schedule

Unit	**Topic**	**No of Lecture hrs.**
1.1	Water relations in plants: Water – Physical and Chemical properties – Physiological role in plants, Water potential- Definition and components	4
1.2	Water absorption mechanism - Imbibition, Diffusion and Osmosis –Ascent of sap: Definition – Theories – Physical-force and vital	4
1.3	Transpiration – Defintion and Types; Stomatal organization and movement – physiological mechanism: Starch-sugar hypothesis, active K^+ transport – Guttation through Hydathodes – Transpiration advantages to plant	4
2.1	Mineral Nutrition in plants - Categories – Essential and Non-essential, Major &minor elements: Physiological role and deficiency symptoms	4
2.2	Passive Absorption and Active Absorption – Theories – Carrier concept, ion channels, ATPase pump	4
2.3	Solute Translocation: Definition- Evidences showing translocation through phloem; Protoplasmic streaming and Münch's Pressure flow theories	4
3.1	Photosynthesis: Photobiology – Action and Absorption spectrum – Quantum yield –Complementary colour in relation to photosynthesis – Emerson's red drop and Light intensity enhancement phenomena	4
3.2	Structural and molecular organization of Chloroplast in higher plants – Photosynthetic unit organization – Photochemical Reaction – Organization of PS-I and PS-II - Photophosphorylation – 'Z' scheme-	4
3.3	Dark Reaction - Calvin & Benson (C3) cycle- C4 cycle and CAM pathway – Overall mechanism of photorespiration (C2 cycle) and its significance	4
4.1	Respiratory Metabolism - Respiratory quotient (RQ)Aerobic respiration – Glycolysis – TCA cycle – Oxidative Phosporylation – Pentose Phosphate Pathway and glyoxylate cycle.	5
4.2	Anaerobic respiration – Fermentation reaction (brief account only) Factors affecting respiration- gluconeogenesis;	2
4.3	Nitrogen metabolism – Nitrogen availability sources to plants- N_2 fixation - Environmental, Biological nitrogen fixation – Free-living, symbiotic organisms and processes (Brief account only) – Nitrogen cycle	5

5.1	PlantGrowth Regulators – auxins, gibberellins, cytokinins, abscissic acid and ethylene- general structure and physiological role in plants	4
5.2	Photomorphogenesis: Concept, photoreceptors – phytochrome – types and physiological role in flowering- Fruit ripening- mechanism – ripening enhancement methods; Seed dormancy and seed germination	4
5.3	Vernalization: Definition, mechanism and significance. Nicky-nasty plant movements – Phototropism, thigmotrophism and diurnal plant movements	4

Thiagarajar College (Autonomous): Madurai – 625 009
Department of Botany
(For those joined B. Sc., Botany on or after June 2019)
Programme Code-UBO

Course Code	Course Title	Category	L	T	P	Credit
UBO19CL61	**Plant Physiology Lab**	**Core Lab-8**			**4**	**2**

Year	Semester	Int. Marks	Ext.Marks	Total
Third	Sixth	40	60	100

Preamble

Imparting the knowledge to the students in the subject of various categories of Plant Physiology, which controls the growth functions in plants

Course Outcomes

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

#	Course Outcome	Knowledge Level (according to Bloom's Taxonomy)
CO1	Explain the functional approach of plants with relation to water status in plants through membrane permeability	K1
CO2	Calculate stomatal frequency	K2
CO3	Depict the photosynthetic functions of plants	K2
CO4	Calculate respiratory quotient	K2
CO5	Measure growth of plants	K3

K1 - Knowledge   K2 - Understand   K3 – Apply

Mapping of Course Outcomes with Programme Specific Outcomes

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

S-Strong M-Medium L-Low

I) Experiments

1. Determination of water potential of given plant material, using

   Gravimetric method,
   Plasmolytic method and
   Charkadov's falling-drop method
2. Determination of imbibition rate of the given seeds, kept under varying temperature conditions
3. Determination of membrane permeability of the given plant material in varying temperature conditions
4. Determination of membrane permeability of the given plant material, kept in varying concentration of detergent solution
5. Determination of stomatal frequency and stomatal index in the given plant leaf
6. Determination of photosynthetic efficiency of *Hydrilla* plants, kept under different nature of monochromatic light conditions
7. Determination of photosynthetic efficiency of *Hydrilla* plants, kept under different concentration of sodium bicarbonate solution
8. Measurement of leaf area in ascending/descending leaf positions from *Acalyphaindica* plant

II) Demonstration

1. Ascent of sap in *Balsam* plant
2. Potato osmoscope
3. Ganong'spotometer for the rate of transpiration
4. Importance of light by Ganong's light-screen experiment
5. Respiration efficiency of germinating seeds using repirsocope
6. Kune's tube – Fermentation
7. Clinostat
8. Lever auxonometer

III.Spotters using specimens/mo

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Programme Code-UBO

Course Code	Course Title	Category	L	T	P	Credit
UBO19C62	Biotechnology	Core-11	4	-	-	4

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

Preamble

To equip the students with the basic principles of biotechnology, updated methodologies, techniques applied aspects of Plant Biotechnology

Course Outcomes

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

#	Course Outcome	Knowledge Level (according to Bloom's Taxonomy)
CO1	Explain the basic principles of biotechnological innovations	K1
CO2	Distinguish between the types of fermentation	K2
CO3	Demonstrate the production of biofuels and Biopesticides	K2
CO4	Depict the production of organic acids through biotechnology	K3
CO5	Prepare medium for tissue culture and produce plants	K3

K1 - Knowledge K2 - Understand K3 - Apply

Mapping of Course Outcomes with Programme Specific Outcomes

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

S-Strong M-Medium L-Low

Blooms taxonomy: Assessment Pattern

	CA		End of Semester
	First	Second	
Knowledge	40%	40%	40%
Understand	40%	40%	40%
Apply	20%	20%	20%
Total	52	52	140

Unit I: Biotechnology-introduction and application in various fields. Genetic engineering tools: restriction endo nuclease, DNA ligase, reverses transcriptase, alkaline phosphatase. Vectors-Plasmid vectors, lambda bacteriophage vectors, methods of transferring desired gene into vectors – transformation techniques, Screening for selection of clones – replica plating method, colony hybridization.

Unit II: Fermentation – solid state fermentation (SSF) – submerged state fermentation (SmSF) – Batch, continuous, fed batch fermentation – design of batch fermentor, alcoholic fermentation: industrial production of beer, wine and industrial alcohol.

Unit III: Biofuels: Methanogenesis and biogas production, Biodyes, Petrocrops, Biodegradable plastics. Biopesticides – *Bacillus thuringiensis*. Mass production of single cell protein: Yeast and *Spirulina.*

Unit IV: Industrial production of organic acid (citric acid), Enzymes: amylase, amino acid (glutamic acid), vinegar, enzymes (protease), Immobilization of enzymes, antibiotics – penicillin, Monoclonal antibodies.

Unit V: Plant tissue culture: Introduction, principles, callus culture, suspension culture, organogenesis and application of plant tissue culture, transgenic plants: Insect resistance, Herbicide resistant plants, golden rice, agar production, alginate production, cultivation of sea weeds.

Text Books:

1. Dubey R.C., 2002. A Text Book of Biotechnology, S. Chand and Co. New Delhi.
2. Patel A.H., 1996. Industrial Microbiology. Mac Millan India Ltd. Delhi.
3. Slater, A., N.W. Scott and M.R.Fowler. 2009. Plant Biotechnology: the genetic manipulation of plants, Oxford University Press, US.

References:

1. Ignacimuthu, S.J., 1997. Plant Biotechnology, Oxford and IBH Publishing Company, New Delhi.
2. Kumaresan V. 1994. Biotechnology, Saras Publications, Nagercoil.

Course designers:

1. Dr. K. Jegathesan
2.Dr. M. Viji

Lecture Schedule

Unit	Topic	Lecture hrs.	Method
1.1	Biotechnology-introduction and application in various fields.	2	Black Board
1.2	Genetic engineering tools: restriction endo nuclease, DNA ligase, reverses transcriptase, alkaline phosphatase.	4	Power Point
1.3	Vectors-Plasmid vectors, lambda bacteriophage vectors	4	Smart Board
1.4	Methods of transferring desired gene into vectors – transformation techniques.	3	Black Board
1.5	Screening for selection of clones – replica plating method, colony hybridization.	2	Power Point
2.1	Fermentation – solid state fermentation (SSF) – submerged state fermentation (SmSF) – Batch, continuous,	4	Black Board
2.2	Fed batch fermentation – design of batch fermentor,	3	Power Point
2.3	Alcoholic fermentation: industrial production of beer, wine and industrial alcohol.	3	Group Discussion
3.1	Biofuels: Methanogenesis and biogas production,Biodyes,	4	Black Board
3.2	Petrocrops, Biodegradable plastics.	3	Power Point
3.3	Biopesticides – *Bacillus thuringiensis*. Mass production of single cell protein: Yeast and *Spirulina.*	4	Power Point
4.1	Industrial production of organic acid (citric acid), Enzymes: amylase, amino acid (glutamic acid), vinegar,	5	Peer group Learning
4.2	Enzymes (protease), Immobilization of enzymes, antibiotics – penicillin,.	5	Black Board
4.3	Monoclonal antibodies	2	Black Board
5.1	Plant tissue culture: Introduction, principles, callus culture, organogenesis and application of plant tissue culture	4	Black Board
5.2	Transgenic plants : Insect resistance, Herbicide resistant plants	4	Black Board
5.3	Golden rice, agar production, alginate production, cultivation of sea weeds	4	Black Board
Total		**60**	

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Department of Botany

(For those joined B. Sc., Botany on or after June 2019)

Programme Code-UBO

Course Code	Course Title	Category	L	T	P	Credit
UBO19CL62	**Biotechnology Lab**	**Core Lab - 9**		**-**	**4**	**2**

Year	Semester	Int. Marks	Ext.Marks	Total
Third	Sixth	40	60	100

Preamble

To equip the students with the basic principles of biotechnology, updated methodologies, techniques applied aspects of Plant Biotechnology

Course Outcomes

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

#	Course Outcome	Knowledge Level (according to Bloom's Taxonomy)
CO1	Isolate DNA from Plants	K1
CO2	Produce and estimate alcohol by fermentation	K2
CO3	Demonstrate Immobilization of microbes	K2
CO4	Depict the production of organic acids through biotechnology	K3
CO5	Prepare medium for tissue culture and produce plants	K3

K1 - Knowledge K2 - Understand K3 - Apply

Mapping of Course Outcomes with Programme Specific Outcomes

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

S-Strong M-Medium L-Low

1. Isolation of genomic DNA fromOnion

2. Demonstration of wine fermentation – estimation ofethanol

3. Yeast biomass estimation by turbiditymethod

4. Cell counting usinghaemocytometer

5. Immobilization of yeast cell

6. *Spirulina*culturing

7. Agar production using *Gracilaria*

8. Antibiotic disc diffusion using cultures of *Penicillium* andactinomycetes

9. Citric acid production using *Aspergillusniger*

10. Amylase production using fungi (Plateassay)

11. Replica plating method for identifying antibiotic resistantmutants

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Department of Botany
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Programme Code-UBO

Course Code	Course Title	Category	L	T	P	Credit
UBO19C63	Plant Ecology and Biodiversity	Core- 12	3	-	-	4

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

Preamble

To inculcate the knowledge on components and interactions in the environment with their values

Course Outcomes

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

#	Course Outcome	Knowledge Level (according to Bloom's Taxonomy)
CO1	Comprehend the components in an ecosystem.	K1
CO2	Recognize the pattern of interactions among the living organisms	K2
CO3	Sensitize the causes and consequence of natural and man-made disasters	K2
CO4	Acquire the values of biodiversity	K2
CO5	explore the methods of conservation of nature	K3

K1 - Knowledge K2 - Understand K3 - Apply

Mapping of Course Outcomes with Programme Specific Outcomes

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

S-Strong M-Medium L-Low

Blooms taxonomy: Assessment Pattern

	CA		End of Semester
	First	**Second**	
Knowledge	40%	40%	40%
Understand	40%	40%	40%
Apply	20%	20%	20%
Total	52	52	140

Unit I: Ecology – Introduction, concept and scope. Ecosystem –types- aquatic, terrestrial Components and their interrelationships; Food chain, Food web; Energy flow in ecosystems, Ecological pyramid models; Biogeochemical cycles – Carbon cycle and Nitrogen cycle

Unit II : Ecological succession – Definition and terminologies – Hydrosere and Xerosere; Autecology –Plant adaptations (External and internal structures only) – Hydrophytes and Xerophytes, Synecology - Interrelationships among organisms – Mutualism and Parasitism

Unit III: Natural disasters (causal factors and impacts only) – Cyclones, landslides volcanic eruption – Pollution – Categories – Causal factors, effects and control measures – Air pollution, water pollution and noise pollution; Global Warming and Green House effect – Natural and man-made causes and impacts – preventive measures – Climate Change Summits - Rio Summit (1992) and Warsaw Summit (2013).

Unit IV: Biodiversity – Scope of the study – Components and Categories of biodiversity; Diversity Hotspots – Hotspots in India, Forest Types. Biodiversity values – Consumptive, productive, ethnobotanical values; – Methods of vegetation analysis – Quadrat method – frequency, density, abundance.

Unit V : Biodiversity conservation – Categories – *In-situ* and *ex-situ* methods: Reserve forests, National Park, Wildlife sanctuaries – *Ex-situ* methods: Botanical garden, seed bank. IUCN Red Data Book – Forest Protection Act and Biodiversity Protection Act (Key features only)

Text Books:

1. Saha, T.K.. 2011. Text Book of Ecology & Environmental Biology, Books and Allied Publishers, Kolkatta.

2. Krishnamurthy, K.V. 2004. Text Book of Biodiversity, Oxford and IBH Publishing Company Pvt. Ltd., New Delhi.

Reference Books:

1. Peter Stiling. 2002. Ecology: Theories and Applications, Prentice-Hall of India, New Delhi.
2. Daniels, R.J.B. and J.K. Krishnamoorthy. 2009. Environmental Studies, Wiley India, New Delhi.
3. Colin R., Townsend, M. Begon and J.L. Harper. 2006. Essentials of Ecology, Second Edition, Blackwell Publications, USA.
4. Dan L. Pelman and Glenn Adelson. 2007. Biodiversity: Exploring values and Priorities in Conservation. Blackwell Publishers, UK.
5. David William Pearce and Dominic Moran. 2013. The Economic value of Biodiversity, Routledge, Taylor & Francis Group, UK.

Course designer

1. Dr. K.Saraswathi

Lecture Schedule

	Topic	No of lecture hrs.	Method
1.1	Ecology – Introduction, concept and scope	1	Black Board
1.2	Aquatic and terrestrial Ecosystem	2	PPT
1.3	Ecosystem - Components and their interrelationships	2	Black Board
1.4	Food chain and Food Web	1	PPT
1.5	Energy flow in ecosystems	1	Black Board
1.6	Ecological pyramid models	1	PPT
1.7	Carbon and Nitrogen cycle	1	PPT
2.0	Ecological succession	1	PPT
2.1	HydrosereandXerosere	1	PPT
2.2	Autecology and Synecology	1	Black Board
2.3	Hydrophytes	2	PPT
2.4	Xerophytes	2	PPT
2.5	Mutualism and Parasitism	2	PPT
3.0	Cyclones and Landslides volcanic eruption	1	PPT
3.1	Air Pollution -Causal factors, effects and control measures	2	PPT
3.2	WaterPollution -Causal factors, effects and control measures	2	PPT
3.3	NoisePollution -Causal factors, effects and control measures	2	PPT
3.4	Global summits	1	Black Board
3.5	Global Warming and Green House effect	2	PPT
4.1	Biodiversity – Scope, Components and Categories	2	Black Board
4.2	Hotspots in India	1	PPT
4.3	Forest Types	2	PPT
4.4	Biodiversity values	2	Black Board
4.5	Methods of vegetation analysis	2	Black Board and Practical calculation
5.1	Biodiversity conservation – Categories – *In-situ* and *ex-situ* methods	3	Black Board and PPT
5.2	IUCN Red Data Book	3	PPT
5.3	Forest Protection Act and Biodiversity Protection Act	2	PPT
TOTAL		**45**	

Thiagarajar College (Autonomous): Madurai – 625 009

Department of Botany

(For those joined B. Sc., Botany on or after June 2019)

Programme Code-UBO

Course Code	Course Title	Category	L	T	P	Credit
UBO19CL63	Plant Ecology and Biodiversity Lab	Core Lab - 10			4	2

Year	Semester	Int. Marks	Ext.Marks	Total
Third	Sixth	40	60	100

Preamble

To inculcate the knowledge on components and interactions in the environment with their values

Course Outcomes

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

#	Course Outcome	Knowledge Level (according to Bloom's Taxonomy)
CO1	Construct quadrats	K1
CO2	Calculate IVI	K2
CO3	Estimate DO And other nutrients	K2
CO4	Depict xerophytic adaptations	K2
CO5	explore the hydrophytic adaptations	K3

K1 - Knowledge K2 - Understand K3 – Apply

Mapping of Course Outcomes with Programme Specific Outcomes

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

S-Strong M-Medium L-Low

1. Study of plant community by Quadrat method.
2. Calculation of important value index.
3. Determination of dissolved oxygen in the given water sample.
4 Determination of free CO_2 in the given water sample.
5 Determination of chlorides in the water sample.
6 Determination of soil organic carbon
7 Determination of soil nitrogen
8 Determination of BOD
9 Study of morphology and anatomy of hydrophytes (any two)
10 Study of morphology and anatomy of xerophytes (any two)

Thiagarajar College (Autonomous): Madurai – 625 009

Department of Botany

(For those joined B. Sc., Botany on or after June 2019)

Programme Code-UBO

Course Code	Course Title	Category	L	T	P	Credit
UBO19CE61(B)	Basics of Molecular Biology	Core Elective- 2	5	-	-	6

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

Preamble

To acquire the knowledge of gene architecture and expression

Course Outcomes

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

#	Course Outcome	Knowledge Level (according to Bloom's Taxonomy)
CO1	demonstrate the mechanism of replication	K1
CO2	explain errors during replication and repair mechanisms	K2
CO3	explain the mechanism of transcription	K2
CO4	differentiate various post transcriptional modifications	K3
CO5	depict the mechanism of translation	K3

K1 - Knowledge K2 - Understand K3 - Apply

Mapping of Course Outcomes with Programme Specific Outcomes

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

S-Strong M-Medium L-Low

Blooms taxonomy: Assessment Pattern

	CA		**End of Semester**
	First	**Second**	
Knowledge	40%	40%	40%
Understand	40%	40%	40%
Apply	20%	20%	20%
Total	52	52	140

Unit I: DNA Replication - general principles and types - bidirectional replication,Semiconservative, Semidiscontinuous. Various models of DNA replication - rolling circle, D3loop (mitochondrial), Ɵ (theta) mode of replication (brief account only). Enzyme involved in DNA replication – DNA polymerases, DNA ligase, Primase, Telomerase and other accessory proteins

Unit II: Replication Errors, DNA Damage–Types of damage. DNA Repair–types andmechanisms

Unit III: Mechanism of Transcription - RNA Polymerase and the transcription unitTranscription in Prokaryotes Transcription in Eukaryotes

Unit IV: RNA Modifications - Split genes, concept of introns and exons, removal of Introns,spliceosome machinery, splicing pathways, alternative splicing. 5' capping and 3' poly A tailing

Unit V: Translation (Prokaryotes and Eukaryotes) Assembly line of polypeptide synthesis 3ribosome structure and assembly, various steps in protein synthesis. Charging of tRNA, aminoacyl tRNA synthetases. Proteins involved in initiation, elongation and termination of polypeptides.

Text books:

Freifelder, D. Molecular Biology.
Singh, B.D., 1998. Biotechnology. Kalyani publishers, New Delhi.
Sheeler, P. and D.E. Binachi 2004. Cell &Molecular Biology, John Wile & Sons, NewYork
Gupta, P.K.1994. Elements of Biotechnology, Rastogi and Co., Meerut, India.

Course designers 1. Dr. K. Jegathesan 2. Dr.M.Viji

Thiagarajar College (Autonomous): Madurai – 625 009

Department of Botany

(For those joined B. Sc., Botany on or after June 2019)

Programme Code-UBO

Course Code	**Course Title**	**Category**	**L**	**T**	**P**	**Credit**
UBO19CE61(N)	Nutraceuticals	Core Elective- 2	5	-	-	6

Year	**Semester**	**Int. Marks**	**Ext.Marks**	**Total**
Third	Sixth	25	75	100

Preamble

To acquire theknowledge of Nutracelicals

Course Outcomes

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

#	Course Outcome	Knowledge Level (according to Bloom's Taxonomy)
CO1	Know about Nutraceutical Industry	K1
CO2	Nutraceuticals of plant and animal origin	K2
CO3	Explore about the nutrition and diet	K2
CO4	Recognize the concepts of diets	K3
CO5	Enumerate the probiotics and prebiotics	K3

K1 - Knowledge K2 - Understand K3 - Apply

Mapping of Course Outcomes with Programme Specific Outcomes

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

S-Strong M-Medium L-Low

Blooms taxonomy: Assessment Pattern

	CA		**End of Semester**
	First	**Second**	
Knowledge	40%	40%	40%
Understand	40%	40%	40%
Apply	20%	20%	20%

Lecture Schedule

Unit	Topic	Lecture hrs.	Method
1.1	Introduction to Nutraceutical Industry,	2	Black Board
1.2	classification of nutraceuticals, dietary supplements,	4	Power Point
1.3	fortified foods, functional foods and phytonutracuticals.	4	Smart Board
1.4	Scope involved in the Industry	3	Black Board
1.5	Indian and global scenario	2	Power Point
2.1	Nutraceuticals of plant and animal origin, Plant secondary metabolites,	5	Black Board
2.2	Alkaloids, phenols, Terpenoids. Nutraceutical applications of Greens, cereals, pulses, nuts and diary.	5	Power Point
2.3	Role of medicinal and aromatic plants in nutraceutical industry propagation.	5	Group Discussion
3.1	Nutrition related diseases and disorders. Carbohydrates, Protein and Fat	5	Video lecture
3.2	Excess and deficiency disorders.	5	Power Point
3.3	Role of nutraceuticals in the prevention and treatment with special reference to diabetes mellitus and hypertension. Diabetic rice.	5	Power Point
4.1	Concept, Biochemistry of nutrition and dietetics Balanced Diet, Food Pyramid,.	5	Peer group Learning
4.2	Nutritional Assessment of Carbohydrates, Proteins.	5	Black Board
4.3	Nutritional Requirements in daily diet. Introduction to nanobiotechnology with special reference to nutraceuticals	5	Black Board
5.1	Microbial and algal nutraceuticals, Concept of prebiotics and probiotics -	5	Power point presentation
5.2	principle, mechanism, production and applications of prebiotics and probiotics.	4	Black Board
5.3	Biotechnology in Phytonutraceuticals.	5	Black Board
Total		**75**	

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Department of Botany
(For those joined B. Sc., Botany on or after June 2019)
Programme Code-UBO

Course Code	Course Title	Category	L	T	P	Credit
UBO19SE61(D)	MUSHROOM TECHNOLOGY	Skill Enhancement Course-2	2	-	-	2

Year	Semester	Int. Marks	Ext.Marks	Total
Third	Sixth	15	35	50

Preamble

To equip the students with the basic ideas of mushroom types, cultivation techniques of edible mushrooms,

Course Outcomes

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

#	Course Outcome	Knowledge Level (according to Bloom's Taxonomy)
CO1	Explain the morphology and internal structure of mushrooms	K1,K2
CO2	Production of spawn, inoculation technique and cultivation	K2, K3
CO3	explain nutritive and medicinal value of edible mushroom	K1
CO4	Preparing mushroom food recipes	K3

K1 - Knowledge K2 - Understand K3 - Apply

Mapping of Course Outcomes with Programme Specific Outcomes

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

S-Strong M-Medium L-Low

Blooms taxonomy: Assessment Pattern

	CA		End of Semester
	First	Second	
Knowledge	40%	40%	40%
Understand	40%	40%	40%
Apply	20%	20%	20%
Total	52	52	140

Unit I: Mushrooms-Introduction-Types of mushrooms: Edible, non-edible mushrooms andmedicinal mushrooms. Morphology and internal structure of mushrooms. Favourable conditions for mushroom cultivation, importance and nutritive value of edible mushrooms. Mushroom food recipes.

Unit II:. Production of mother spawn, multiplication of spawn ,Inoculation Technique,Cultivation technology, Substrates, composting technology, bed, polythene bag preparation, spawning, casing , Cropping, Commercial cultivation of mushrooms: *Agaricus* and *Pleurotus*– problems in cultivation-pests, diseases and microbes and its control measures. Post harvest technology and storage methods for mushrooms.

Text Books:

1.Nita Bahl. 1996, Hand Book On Mushrooms. Oxford and IBH Publishing Company Ltd., New Delhi.

2.Kapoor, J.N. 1989. Mushroom Cultivation, ICAR, New Delhi.

3..Tripathi, D. P. 2005. Mushroom Cultivation. Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi.

Reference Books:

1.Aneja, K.R.1993. Experiments in Microbiology, Plant pathology, Tissue culture and mushroom cultivation, WishwaPrakashan, New Age International (P) Ltd., New Delhi.

2.Chang,S. and Miles, P.G. 2004. Mushrooms: Cultivation, Nutritional Value, Medicinal Effect and Environmental Impact, CRC Press online.

Lecture Schedule

Unit	**Topic**	**Lecture hrs.**	**Method**
1.1	Introduction and types of mushrooms	2	Black Board
1.2	Edible ,non-edible and medicinal mushrooms	3	Black Board
1.3	Morphology and internal structure of mushrooms	3	Power Point
1.4	Mushroom cultivation	3	Power Point
1.5	Nutritive value of edible mushrooms and mushroom recipes	3	Power Point
2.1	Spawn production	4	Power Point
2.2	Cultivation technology	3	Black Board
2.3	Bed, polythene bag preparation	3	Power Point
2.4	Pest and disease control measures	3	Black Board
2.5	Post harvest technology and storage methods	3	Black Board
Total		**30**	

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Department of Botany
(For those joined B. Sc., Botany on or after June 2019)
Programme Code-UBO

Course Code	Course Title	Category	L	T	P	Credit
UBO19SE61(E)	FOOD PROCESSING TECHNOLOGY	Skill Enhancement Course-2	2	-	-	2

Year	Semester	Int. Marks	Ext.Marks	Total
Third	Sixth	15	35	50

Preamble

To equip the students with the basic ideas of mushroom types, cultivation techniques of edible mushrooms,

Course Outcomes

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

#	Course Outcome	Knowledge Level (according to Bloom's Taxonomy)
CO1	Classify various types of foods and its importance in human nutrition.	K1,K2
CO2	explain the food ingredients	K2, K3
CO3	calculate calorific values of various foods	K1
CO4	acquire information about food processing techniques.	K3

K1 - Knowledge K2 - Understand K3 - Apply

Mapping of Course Outcomes with Programme Specific Outcomes

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

S-Strong M-Medium L-Low

Blooms taxonomy: Assessment Pattern

	CA		End of Semester
	First	Second	
Knowledge	40%	40%	40%
Understand	40%	40%	40%
Apply	20%	20%	20%
Total	52	52	140

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Unit I: Food: Introduction, Classification of food-plant-fruits, vegetables, cereals, pulses-animal-Milk, egg, meat, fish and microbial sources- Single cell protein-*Spirullina*, Yeasts and mushrooms. Nutrients of food- macro and micro nutrients, Deficiency causes disorders and syndromes.

Unit II: Food processing: Principles, methods-physical and chemical - mincing, macerating,liquefaction, emulsification, cooking (boiling, broiling, frying or grilling), pasteurization,. Fermentors and types for food processing, Preservation methods-Principles-irradiation, drying, heat, chilling and freezing, osmotic pressure and chemical preservatives.

Text Books:

Patrica Trueman, 2007. Nu*tritional Biochemistry, MJP Publishers.*

Shankuntala Manay, N. and M.Shadaksharaswamy, 2014. Foods-Facts and Principles. 3rd Edn. New Age, International (P) Limited Publishers.

Reference Books:

William C Frazier, Dennis C Westhoff, Adapted by N.M.Vanitha, 2014. Mc Graw Hill Education(India) Private Limited, New Delhi.

Journal of Beverage and food world- Nov, 2008, vol.30,33 and 35.

Course designers

Dr.B.Sadhana

Dr. V.Karthikeyan

Thiagarajar College (Autonomous): Madurai – 625 009
Department of Botany
(For those joined B. Sc., Botany on or after June 2019)
Programme Code-UBO

Course Code	Course Title	Category	L	T	P	Credit
UBO19SE61(F)	Seed and Nursery Technology	Skill Enhancement Course-2	2	-	-	2

Year	Semester	Int. Marks	Ext.Marks	Total
Third	Sixth	15	35	50

Preamble

To equip the students with the basic ideas of mushroom types, cultivation techniques of edible mushrooms,

Course Outcomes

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

#	Course Outcome	Knowledge Level (according to Bloom's Taxonomy)
CO1	differentiate between dicot and monocot seeds	K1,K2
CO2	explain the basics of seed technology	K2, K3
CO3	construct Nursery	K1
CO4	prevent seed deterioration	K3

K1 - Knowledge K2 - Understand K3 – Apply

Mapping of Course Outcomes with Programme Specific Outcomes

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

S-Strong M-Medium L-Low

Blooms taxonomy: Assessment Pattern

	CA		End of Semester
	First	**Second**	
Knowledge	40%	40%	40%
Understand	40%	40%	40%
Apply	20%	20%	20%
Total	30	30	65

Unit – I: Seed, Definition, structure of monocot and dicot seed, Type of seeds, seedcollection, storage, treatment, viability, seed germination test, Seed germination – patterns, types and requirements for germination, Germination stimulators, inhibitors and hormones. Different agencies connected with seed trade.

Unit – II: Seed drying and processing, seed health testing, Characteristic of good seed.Difference between seed and grain, monoembryony, polyembryony. Seed protection, labeling and certification, seed dormancy – types, causes and methods of breaking dormancy, advantage and disadvantage. Seed deterioration – symptoms and causes, packaging,

Textbooks:

1.Agrawal RL. 1996. *Seed Technology*. Oxford Publ.
2.Barton LV. 1985. *Seed Preservation and Longevity*. International Books and Periodicals Supply Service, New Delhi.

Course designers:
Dr.K.Rajendran
Dr. R.Aruna

Generic Elective
(Allied Papers)

Offered by Botany Department

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

Generic Elective course Syllabus
For Microbiology Major Students – w.e.f. 2019 June

Major	Year	Sem	Code	Title of the Paper	Cont Hrs/W	Credit
Microbiology	II	III	UBO19GE31Z	Plant Life Forms and Utilization	4	4
Microbiology	II	III	UBO19GL41Z	Plant Life Forms and Utilization & Plant Pathology Lab	2	--
Microbiology	II	IV	UBO19GE41Z	Plant Pathology	4	4
Microbiology	II	IV	UBO19GL41Z	Plant Life Forms and Utilization & Plant Pathology Lab	2	2

Scheme of Examinarion

Mark Statements:	Internal (CA)	External (Sum)
Theory:	25	75
Practical:	40	60

Minimum Marks required

	Internal (CA)	External (Sum)	CA + SUM
Theory	Nil	27 / 75	35%
Practical	Nil	21 / 60	35%

Thiagarajar College (Autonomous): Madurai – 625 009

Department of Botany

(For those joined B. Sc., Microbiology on or after June 2019)

Course Code	Course Title	Category	L	T	P	Credit
UBO19GE31Z	Plant Life Forms and Utilization	Generic Elective	4	-	-	4

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

Preamble

To acquire theknowledge of various plant life forms

Course Outcomes

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

#	Course Outcome	Knowledge Level (according to Bloom's Taxonomy)
CO1	differentiate various plant groups	K1
CO2	explain the botanical name and utility values of plants and their parts	K2
CO3	depict plant-animal interaction in certain useful products	K2
CO4	devise and develop entrepreneurial skills	K3
CO5	utilize plants for wasteland development	K3

K1 - Knowledge K2 - Understand K3 - Apply

Mapping of Course Outcomes with Programme Specific Outcomes

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

S-Strong, M-Medium, L-low

Blooms taxonomy: Assessment Pattern

	CA		End of Semester
	First	Second	
Knowledge	40%	40%	40%

Understand	40%	40%	40%
Apply	20%	20%	20%
Total	52	52	140

Unit I: Cryptogams - General characteristic features and economic importance of Algae,Fungi, Lichens, Bryophytes, Pteridophytes (Excluding the development details of sporophyte and gametophyte). External Morphology and life cycle study (Excluding the development details) of the following plants: Algae – *Gracilaria*, Fungi – *Aspergillus*; Lichen – *Usnea*; Bryophyte – *Marchantia*; Pteridophyta – *Psilotum*

Unit II: Phanerogams–Gymnosperms - General characteristic features and economicimportance (Excluding the developmental details of sexual organs and embryo); Morphology, anatomy, life cycle study (Excluding developmental details) of *Pinus*; **Paleobotany** – Geological era and Fossilization process – Compression, Impression and Pterification Fossil Pteridophytes: *Rhynia major* structure

Unit III: Phanerogams–Angiosperms - Dicots and Monocots–General characters and theirdifference – General Botanical Nomenclature rules – Bentham and Hooker's outline classification (Excluding merits and demerits) – External morphology and floral characteristic features and economic importance of the following Families: Nymphaceae, Bignoniaceae, Euphorbiaceae and Musaceae

Unit IV: Utility values of plants–Vernacular Tamil and English names, botanical name,parts used and uses of the following: Food grains – Rice,Wheat and Maize; Pulses – Red gram and Bengal gram; Vegetables – Tomato and Pumpkin; Fruits – Apple and grapes; Medicinal plants – Tulsi, *Phyllanthus niruri*, Fox-glove; Edible oil crops – Ground nut oil and coconut oil; Beverages – Coffee and Tea; Fibre – Cotton and Jute; Wood – Teak and rose wood; Rubber – Para rubber; Gum and Resin – Gum Arabic and Canada Balsam

Unit V: Plant–Animal Interaction based products–, botanical and zoological names, briefdetail on the process and uses of the following: Silk fibre, Lac and shellac; Plants based small scale industrial production / services – SCP production through *Spirulina* culture; Organic fertilizer production using Sea weeds; Plants used in Environmental Management Phytoremediation process of purification of polluted and contaminated water; Plants used in controlling soil erosion and wasteland development

Text Books:

Pandey, B.P. 2012.' Economic Botany', S. Chand & Company Ltd, New Delhi.
Pandey,B.P. 2010, 'College Botany, Volumes. I, II and III', S. Chand & Company Ltd., New Delhi
Singh, V., Jain, D.K. and Panda, P.C., 2010. 'A Text Book of Botany: Angiosperms', Rastogi Publications, Meerut
Sambamurthy, A.V.S.S. and N.S. Subramanyam. 1989. 'A Text Book of Economic Botany', Wiley-Eastern Ltd, New Delhi.

Reference Books:

Colin R. Townsend, 2007. 'Ecological Applications: Toward a Sustainable World', Wiley Blackwell, UK.
Kochhar, S.L. 1995. 'Economic Botany in the Tropics', Macmillan India Ltd., Delhi.
Sharma, O.P. 1996. 'Economic Botany', Tata McGraw Hill Co. Ltd. New Delhi.

Course Designer:
Dr. D. Kannan

Thiagarajar College (Autonomous): Madurai – 625 009
Department of Botany
(For those joined B. Sc., Microbiology on or after June 2019)

Course Code	Course Title	Category	L	T	P	Credit
UBO19GE41Z	Plant Pathology	Generic Elective	4	-	-	4

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

Preamble
To acquire theknowledge of plant pathology

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

#	Course Outcome	Knowledge Level (according to Bloom's Taxonomy)
CO1	Know about plant pathology techniques	K1
CO2	Comprehend about epidemiology	K2
CO3	Explore about the genomes	K2
CO4	Recognize the plant disease symptoms	K3
CO5	Enumerate the plant control strategies	K3

K1 - Knowledge K2 - Understand K3 - Apply

Mapping of Course Outcomes with Programme Specific Outcomes

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

S-Strong, M-Medium, L-low

Blooms taxonomy: Assessment Pattern

	CA		End of Semester
	First	Second	
Knowledge	40%	40%	40%
Understand	40%	40%	40%

Apply	20%	20%	20%
Toal	52	52	140

Lecture Schedule

Unit	**Topic**	**Lecture hrs.**	**Method**
1.1	Plant pathology Introduction, history,	2	Black Board
1.2	Concept, Importance, diagnosis and classification Inoculum,	4	Power Point
1.3	penetration, infection, invasion, and dispersal –	4	Smart Board
1.4	plant defense mechanism	3	Black Board
1.5	enzymes, and toxins	2	Power Point
2.1	Epidemiology: forms, reasons of progressive severity of epidemics and decline of epidemics.	4	Black Board
2.2	Recent methods of plant disease forecasting.	3	Power Point
2.3	Concepts of post harvest disease management	3	Group
3.1	Symptomatology Study of the following diseases, symptom manifestation and control measures. 1. Citrus canker 2. Tikka disease of groundnut	4	Video lecture
3.2	3. Cucumber Mosaic virus 4. Smut of Sorghum	3	Power Point
3.3	5. Red rot of Sugar cane	4	Power Point
4.1	Symptomatology Study of the following diseases 1. Cordylobiaanthropophaga, the mango fly 2. Cabbageworm,	5	Peer group Learning
4.2	3.Hairy caterpillar Eupterotemollifera of Drumstick 4.Aphids and worms of Ladies finger plant	5	Black Board
4.3	5. Stem borer of rice	2	Black Board
5.1	Plant disease control Concepts– plant quarantine principles. Eradication –	4	Power point presentation
5.2	crop rotation, field sanitation, soil treatment and seed treatments. Management strategies: physical chemical, and biological.	4	Black Board
5.3	Engineered resistance against fungal, viral and bacterial pathogens.	4	Black Board
Total		**60**	

Thiagarajar College (Autonomous): Madurai – 625 009

Department of Botany

(For those joined B. Sc., Microbiology on or after June 2019)

Course Code	Course Title	Category	L	T	P	Credit
UBO19GL41Z	Plant Life Forms and Utilization Lab and Plant Pathology Lab	Generic Elective Lab			2+2 = 4	2

Year	Semester	Int. Marks	Ext.Marks	Total
Second	Third and Fourth	40	60	100

Plant Life Forms and Utilization Experiments (III Semester)

Preamble

To acquire the knowledge of plant life forms

Course Outcomes

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

#	Course Outcome	Knowledge Level (according to Bloom's Taxonomy)
CO1	differentiate various plant groups	K1
CO2	explain the botanical name and utility values of plants and their parts	K2
CO3	identify various groups of plant kingdom	K2
CO4	Identify the internal structure of Pinus wood	K3
CO5	utilize plants for wasteland development	K3

K1 - Knowledge K2 - Understand K3 – Apply

Mapping of Course Outcomes with Programme Specific Outcomes

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

S-Strong, M-Medium, L-low

1 .Gracilaria - Thallus morphology, anatomical section of main axis; spermatangia and cystocarps –
Dissection to reveal the anatomical structures
2 .Aspergillus – Conidophore structure Examination, using permanent slide
3 .Usnea – Apothecium structure Examination, using permanent slide
4 .Marchantia – Morphology and Anatomy of thallus structures
5 .Marchantia - Antheridia and Archegonia structures Examination, using permanent slides
6 .Pinus - Wood anatomical structure, Male and Female sex organs structures
7 .Paleobotany – Structural Examination of Compression and Impression fossil specimens , Anatomical structure Examination of Rhyniamajo r stem, using permanent slide
8 .Morphological and floral characteristic study using plant specimens, on the following families:
Nymphaceae, Bignoniaceae, Euphorbiaceae and Musaceae
9 . Specimens, samples of food materials and food products, commercial products, models, pertinent to the syllabus on the economic utilization of plants and through plant - animal interactions and environmental services of plants

Plant pathology Experiments (IV Semester)

Preamble

To acquire the knowledge of plant diseases

Course Outcomes

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

#	Course Outcome	Knowledge Level (according to Bloom's Taxonomy)
CO1	Know about plant pathology techniques	K1
CO2	Comprehend about epidemiology	K2
CO3	Explore about the genomes	K2
CO4	Recognize the plant disease symptoms	K3
CO5	Enumerate the plant control strategies	K3

K1 - Knowledge K2 - Understand K3 - Apply

Mapping of Course Outcomes with Programme Specific Outcomes

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

S-Strong, M-Medium, L- Low

1. Isolation of microbes from food samples, soil and air.
2. I solation of bactreiophages from sewage.
3. Isolation of Rhizobium and Frankia from the nodules.
4. Isolation of rhizobacteria from rhizosphere samples.
5. Isolation of plant pathogens from infected plant materials.
6. Isolation of AM spores by wet sieving - decanting method.
7. Study of diseased materials - Rust by Puccinia.
8. Red rust and White rust.
9. Leaf spot of ground nut.

THIAGARAJAR COLLEGE, MADURAI – 9.
(Re-Accredited with 'A' Grade by NAAC)
ENVIRONMENTAL STUDIES
(For those joined B.A., B.Sc., B.Com., B.B.A., B.C.A on or after June 2019)

Course Code	Course Title	Category	L	T	P	Credit
U19EVS11	**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 Pollutants	K1
CO4	Perceive the environment legislations in India for sustainable development.	K3

K1: Knowledge K2: Understand K3: Apply

Blooms taxonomy: Assessment Pattern

	CA		End of Semester
	First	Second	
Knowledge	40%	40%	40%
Understand	40%	40%	40%
Apply	20%	20%	20%

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 PSOllution – Water PSOllution – Noise PSOllution – Nuclear Hazards. Solid waste management and Waste DisPSOsal 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

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

Reference Books

1. Yogendra, N. and Srivastava, N. 1998. Environmental PSOllution, Ashish Publishing House. New Delhi.

Sapru R.K.2001. Environment Management in India, Vol. I & Vol. II Ashish publishers house, New Delhi.

THIAGARAJAR COLLEGE, MADURAI – 9.

(Re-Accredited with 'A' Grade by NAAC)

VALUE EDUCATION

(For those joined B.A., B.Sc., B.Com., B.B.A., B.C.A on or after June 2019)

Course Code	Course Title	Category	L	T	P	Credit
U19VE51	**Value Education**	AECC1	2	-	-	2

Year	Semester	Int. Marks	Ext.Marks	Total
Third	Fifth	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

Blooms taxonomy: Assessment Pattern

	CA		End of Semester
	First	Second	
Knowledge	40%	40%	40%
Understand	40%	40%	40%
Apply	20%	20%	20%

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

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

விழுமியக் கல்வி

கூறு - 1

சுய முன்னேற்றம்

அறிமுகம் - விழுமியங்களின் விளக்கம் மற்றும் வகைகள் - சுயமதிப்பீடு - சுய முன்னேற்றத்திற்கு விழுமியங்களின் தேவை - குடும்ப வாழ்க்கைக்கு விழுமியங்களின் தேவை - மகிழ்ச்சியான வாழ்க்கைக்கான கொள்கைகள்

பண்பு வளர்ச்சி

நற்பண்பு - நல்லுறவு - உயரிய பண்புகளால் உயர்ந்த பெருமக்களாதல் - பண்புகளைத் தேடல் - பண்புகளை வளர்த்தல் - நற்பண்புகளுக்கான திறவுகோல்.

கூறு - 2

சுயமரியாதையும் நேர்மறைச் சிந்தனையும்

சிந்தனையின் வகைகள் - சிந்தனைப் பகுதிகள் - சிந்தனையை வளர்க்கும் முறை - சிந்தனையில் புறத்தாக்கங்கள் - நேர்மறைப் பண்பை வெளித்தோற்றத்தில் காட்டும்முறை - சுயமரியாதையின் பொருள் - சுய அதிகாரமளித்தல்

அழுத்தமில்லா வாழ்க்கை

பிரமைகளும் காரணங்களும் - அழுத்த நிலைகளுக்கான அறிகுறிகள் - தன்னம்பிக்கை - தலைமைப் பண்பில் முன்னுதாரணங்கள் - விமர்சனச் சிந்தனை - தொடர்புத் திறன்கள் - மகிழ்ச்சி மற்றும் வெற்றிகரமான வாழ்க்கை

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

Self Study Paper

Thiagarajar College (Autonomous) :: Madurai – 625 009
SELF STUDY PAPER
(For those joined UG on or after June 2019)

Course Code	Course Title	Category	L	T	P	Credit
U19SS51	**Soft Skills**	Self Study Paper	-	-	-	5

Year	Semester	Int. Marks	Ext.Marks	Total
Third	Fifth	----	100	100

*** Carries Extra 5 credits that do not form part mandatory credits (140) required for completion of the course. Optional paper not compulsory for all UG students.**

Preamble

Prepare the students to develop skills, provide training to face interview .prepare themselves with the right skill-sets and attitude

Course Outcomes

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

	Course outcomes	Knowledge Level
CO1	Possess a basic idea on the understanding of nature, cause, effect and ways to deal with critical challenges in everyday life	K1,K2
CO2	Overcome the aspects such as Communication barriers, Stress management, Emotions.	K3
CO3	Gain insights into high-in-demand soft skills and prepare themselves with the right skill-sets and attitude	K1,K2
CO4	Develop or take part inteam work, Thinking skills, Creativity and time management.	K3
CO5	Prepare themselves to face different levels of interviews. Develop skills to manage an organization	K3

K1: Knowledge K2: Understand K3: Apply

Blooms taxonomy: Assessment Pattern

	CA		End of Semester
	First	**Second**	
Knowledge	40%	40%	40%
Understand	40%	40%	40%
Apply	20%	20%	20%

Unit - 1

Self Awareness (Concept of Self-esteem, Positive and Negative self esteem) Motivation (Nature and types, Factors enhancing and affecting Motivation, Needs and Drives) (Creativity Introduction, Nature of Creativity, Stages of Creativity, Enhancing Creativity, Verbal and Non Verbal Creativity) Values and Ethics (Nature and Significance, Values, Ethics, Work Ethics, Character building, Manners and Ethics)

Self Management (Self management skills and Social Competency, Social Competency Behaviour, Value Orientation, Life goals)

Unit 2

Communication and Thinking Communication (Definition, Types, Styles, Culture and Communication); Thinking (Nature, Types, Problem Solving, Proactive thinking, Positive Thinking, Assertiveness)

Unit 3

Emotions (Nature of emotions, Emotional Intelligence and its strategies, Attachment, Love, Happiness, Introduction to Anger – Causes, Types, Functions and Consequences, Anger management)

Stress (Nature of stress, Relation between Demands and Coping, Types and Causes, Effects and Indicators, Management of Stress, Time management and Stress reduction) Empathy (Definition, Nature and Factors enhancing empathy)

Unit4

Excelling through a placement process(Resume writing; Taking a written test; Group discussion – Need, Types, Tips and techniques; Interview handling – Tips and Techniques)

Unit 5

Being effective in an organisation

50 rules of work, Professional Etiquettes and Mannerism, Building relationship within an organisation, Communication skills, Working in teams, Managing conflicts, Effective negotiation skills, Problem solving using creativity.

Text book

1. Life Skills for Success – AlkaWadkar – 2016 Edition SAGE | TEXTS Sagepublishing.com
2. Campus to Corporate – Roadmap to Employability – Gangadhar Joshi – 2015 Edition SAGE | TEXTS Sagepublishing.com

Reference textbook

1 ACE of Soft skills – Gopalaswamy Ramesh and Mahadevan Ramesh, Pearson Publication
2 Bridging the soft skills gap – Bruce Tulgan – 2015 Edition – Wiley Publication

B.Sc. Botany

Assessment values of course learning outcomes and their mapping with program specific outcomes (PSOs)

Major Courses

Courses	Sem	Title of the courses	PSO1	PSO2	PSO3	PSO4	PSO5
Core Theory 1	1	Plant Diversity I	10	12	5	13	10
Core Lab 1	1	Plant Diversity I Lab	11	12	9	10	4
Core Theory 2	2	Plant Diversity II	10	12	5	13	10
Core Lab2	2	Plant Diversity II Lab	11	12	9	10	4
Core Theory 3	3	Microbiology and Plant Pathology	11	10	9	9	8
Core Theory 4	3	Cell biology and Plant Anatomy	9	15	7	11	8
Core Lab3	3	Microbiology, Plant Pathology, Cell biology and Plant Anatomy Lab	7	8	7	7	6
Core Theory 5	4	Plant Embryology and Tissue Culture	9	9	8	12	9
Core Theory 6	4	Bioinstrumentation and Computer Applications	8	9	11	11	9
Core Lab4	4	Plant Embryology, Tissue Culture, Bioinstrumentation and Computer Applications Lab	7	8	7	7	6
Core Theory 7	5	Morphology and Taxonomy of Angiosperms	9	14	12	9	9
Core Theory 8	5	Plant Biochemistry	11	12	10	10	9
Core Theory 9	5	Genetics, Evolution and Biostatistics	11	8	8	8	9
Core Lab5	5	Morphology and Taxonomy of Angiosperms Lab	9	14	12	9	9
Core Lab6	5	Plant Biochemistry Lab	9	11	9	9	9
Core Lab7	5	Genetics, Evolution and Biostatistics Lab	11	8	8	8	9
Core Elective 1	5	Horticulture and Plant Breeding	9	10	12	9	10
Core Elective 1	5	Plant Resources and Utilization	8	11	8	15	15
Core Theory 10	6	Plant Physiology	12	13	10	11	10
Core Theory 11	6	Biotechnology	10	8	5	13	9
Core Theory 12	6	Plant Ecology and Biodiversity	9	12	7	12	10
Core Lab 8	6	Plant Physiology Lab	12	12	10	11	10
Core Lab 9	6	Biotechnology Lab	9	8	5	11	9
Core Lab 10	6	Plant Ecology and Biodiversity Lab	9	12	7	12	10
Core Elective 2	6	Basics of Molecular Biology	9	11	7	8	9
Core Elective 2	6	Nutraceuticals	10	10	8	7	11

NME / SBE Courses

Courses	SEM	Title of the courses	PSO1	PSO2	PSO3	PSO4	PSO5
AECC 1	1	Environmentalstudies	1	4	7	3	6
AECC 2	1	Personality Development	0	0	0	15	6
NME 1	3	Gardening	8	8	7	7	6
SBE 1	4	Biofertilizers and Organic farming	4	10	12	6	6
SBE 1	4	Histologyand StainingTechniques	4	8	6	8	6
SBE 1	4	Bioremediation	4	10	12	6	6
NME 2	5	Botanical World	8	7	8	7	7
VE	6	Value Education					
SBE 2	6	Mushroom Technology	7	9	7	11	9
SBE 2	6	Seed and Nursery Technology	7	9	7	11	9
SBE 2	6	Food Processing Technology	7	9	7	11	9

Generic Elective Courses (offered to B.Sc. Botany students by other Departments)

Course	Sem	Title of the courses	PSO1	PSO2	PSO3	PSO4	PSO5
Generic Elective 1 Theory	1	Economic Zoology					
Generic Elective 1 Lab	1	Economic Zoology Lab					
Generic Elective 1 Theory	2	Anc.Zoology1					
Generic Elective 1 Lab	2	Anc.Zoology Lab1					
Generic Elective 2 Theory	3	Anc.Chemistry					
Generic Elective 2 Lab	3	Anc.ChemistryLab					
Generic Elective 2 Theory	4	Chemistry					
Generic Elective 2 Lab	4	Chemistry Lab					

Generic Elective Courses (offered by Botany Department to B.Sc. Microbiology students)

Course	Sem	Title of the courses	PSO1	PSO2	PSO3	PSO4	PSO5
Generic Elective 1 Theory	3	Plant Life forms	9	11	11	9	9
Generic Elective 1 Lab	3	Plant Life forms Lab	9	12	11	10	9
Generic Elective 1 Theory	4	Plant Pathology	9	11	11	9	9
Generic Elective 1 Lab	4	Plant Pathology Lab	9	10	11	12	9

M.Sc., Botany

Programme Code: PBO

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

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.

Recognise 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

M.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 this Programme is to equip/prepare the students

PEO1	Graduates of the program will develop competent knowledge in basic Plant science required for continuous learning and research.
PEO2	Graduates will develop diversified basic professional skills through various laboratory technical training, communication and presentation skills.
PEO3	Graduate will possess an ability to identify, formulate, and solve Plant problems to contribute to service efforts to community in both the professional and private realm
PEO4	Gradates will integrate related topics from separate parts 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.
PEO5	Graduates will be proficient to assess the scope of plant science, appreciate the complexities of biological organization and address scientifically controversial issues in a rational way

Programme specific outcomes- M.Sc.,Botany

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

PO1	carry out a thorough analysis on various plant life forms, using specific identification key characteristic features and also at micro level
PO2	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
PO3	demonstrate the principles of inheritance, basis for plant breeding (through macro propagation and using tissue culture) and latest concepts of molecular biology and biotechnology
PO4	exhibit proficiency in the areas of biostatistics and computer applications in modern topics of Life Sciences
PO5	exhibit proficient laboratory skills and in contemporary and advance techniques related to Life Science

THIAGARAJAR COLLEGE, MADURAI – 9.

(Re-Accredited with 'A' Grade by NAAC)

DEPARTMENT OF BOTANY

Master of Science (M.Sc.,) Botany (w.e.f. 2019 batch onwards)

Programme Code-PBO

Programme Scheme

SEMESTER –I

Course	Code No.	Subject	Contact Hrs/ Week	Credits	Total No. of hours allotted	Max. Marks		Total
						CA	SE	
Core - 1	PBO19C11	Thallophytes, Bryophytes, Pteridophytes and Gymnosperms	6	5	90	25	75	100
Core - 2	PBO19C12	Plant Cell and Molecular Biology	6	5	90	25	75	100
Elective - 1	PBO19CE11	Developmental Botany	6	5	90	25	75	100
Core Lab- 1	PBO19CL11	Thallophytes, Bryophytes, Pteridophytes and Gymnosperms Lab	6	4	90	40	60	100
Core Lab- 2	PBO19CL12	Plant Cell and Molecular Biology Lab	6	4	90	40	60	100
		Total	**30**	**23**	**450**	**155**	**345**	**500**

SEMESTER –II

Course	Code No.	Subject	Contact Hrs/ Week	Credits	Total No. of hours allotted	Max. Marks		Total
						CA	SE	
Core - 3	PBO19C21	Plant Biochemistry and Biotechniques	6	5	90	25	75	100
Core - 4	PBO19C22	Microbiology and Plant Pathology	6	5	90	25	75	100
Elective - 2	PBO19CE21	Computer Applications in Biology and Biostatistics	6	5	90	25	75	100
Core Lab- 3	PBO19CL21	Plant Biochemistry and Biotechniques Lab	6	4	90	40	60	100
Core Lab- 4	PBO19CL22	Microbiology and Plant Pathology Lab	6	4	90	40	60	100
		Total	**30**	**23**	**450**	**155**	**345**	**500**

SEMESTER –III

Course	Code No.	Subject	Contact Hrs/ Week	Credits	Total No. of hours allotted	Max. Marks		Total
						CA	SE	
Core - 5	PBO19C31	Angiosperm Taxonomy	6	5	90	25	75	100
Core - 6	PBO19C32	Plant Physiology	6	5	90	25	75	100
Elective - 3	PZO19ID31	Interdisciplinary Course: Applied Zoology	6	5	90	25	75	100
Core Lab- 5	PBO19CL31	Angiosperm Taxonomy Lab	6	4	90	40	60	100
Core Lab- 6	PBO19CL32	Plant Physiology Lab	6	4	90	40	60	100
		Total	**30**	**23**	**450**	**155**	**345**	**500**

SEMESTER –IV

Course	Code No.	Subject	Contact Hrs/ Week	Credits	Total No. of hours allotted	Max. Marks		Total
						CA	SE	
Core - 7	PBO19C41	Plant Biotechnology	6	5	90	25	75	100
Core - 8	PBO19C42	Plant Ecology, Environment and Evolution	6	5	90	25	75	100
Core Lab- 7	PBO19CL41	Plant Biotechnology lab	6	4	90	40	60	100
Core Lab- 8	PBO19CL42	Plant Ecology, Environment and Evolution lab	6	4	90	40	60	100
Elective – 4	PBO19CE41	Project	6	3	90	40	40+20	100
		Total	**30**	**21**	**450**	**170**	**330**	**500**

Interdisciplinary Course : Applied Zoology (PZO19ID31) **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 **(PBO19ID31) offered by the Department of Botany to M. Sc., Zoology**students in Semester III

Consolidation of Contact Hours and Credits: PG Botany

Semester	Contact Hrs/ Week	Credits
I	30	23
II	30	23
III	30	23
IV	30	21
Total	**120**	**90**

Curriculum Credits

--------Core 75 Credits

Elective -------- 15 Credits

Total 90 Credits

Thiagarajar College (Autonomous): Madurai – 625 009

Department of Botany

(For those joined M. Sc., Botany on or after June 2019)

Programme Code-PBO

Course Code	Course Title	Category	L	T	P	Credit
PBO19C11	Thallophytes, Bryophytes, Pteridophytes andGymnosperms	Core - 1	6	-	-	5

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 (according to Bloom's Taxonomy)
CO1	Comprehend various groups of plants	K1
CO2	Elucidate the phylogenetic sequence of plant groups	K2, K4
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	K3,K5

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

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	60	60	150

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

Unit II: Classification of fungi by Alexopoulos and Mims (1962) - 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 ofHepaticopsida, 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 (1965). 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. Alexopoulos, C.J., Mims, C.W. and Blackwell, M. 1996 - Introductory mycology, John Wiley & Sons Inc., Toronto.
4. Gupta, J.S. 1986. Textbook of fungi. Oxford and IBH publishing company Pvt. Ltd., New Delhi.
5. Vashista B.R & A.K Sinha 2005. Botany for degree students – Bryophta, S. Chand & Co., New Delhi.
6. ChandrakantPathak 2003. First Edition. Bryophyta, Dominant Publishers and Distributors, New Delhi.
7. Rashid, A. 1998. An introduction to bryophytes. Vikas Publishing House Pvt. Ltd., New Delhi.
8. Ahamadjian, V. 1973. The Lichens. Academic Press. New Delhi.
9. Vashista B.R., Sinha A.K., Kumar A. 2008. Botany for degree students - Pteridophyta, S. Chand & Co., New Delhi.

10. Sharma, O.P. 1990. Textbook of Pteridophyta. MacMillan India Ltd., New Delhi.
11. Vashishta. P.C., A.K. Sinha and Anil Kumar. 2007. Botany for Degree students - Gymnosperms. S. Chand & Co., New Delhi.

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.

Course Designer:

Dr.K.Saraswathi

Lecture Schedule

Unit	Topic	Lecture hrs.	Method
1.1	Algae Classification –Chapman	2	Black Board
1.2	Habitats of algae	2	PPT
1.3	Algae – four major classes	6	Black Board
1.4	Thallus organization in algae	2	Specimens and PPT
1.5	Life cycle patterns in algae	2	Black Board and PPT
1.6	Economic importance of algae	2	PPT
2.1	Fungi Classification – Alexopoulos	2	Black Board
2.2	Different classes of fungi	9	Black Board
2.3	Economic Importance of Fungi	2	PPT
2.4	Lichens – structure and Reproduction	2	Specimens and Black Board
2.5	Lichens- Economic Importance	2	PPT
3.1	Bryophytes – classification- Watson	3	Black Board
3.2	Different classes of bryophytes	6	Specimens and Black Board
3.3	Gametophytes of bryophytes	3	PPT
3.4	Sporophytes of bryophytes	3	PPT
3.5	Economic importance of bryophytes	3	PPT
4.1	Pteridophytes – Classification-Smith	3	Black Board
4.2	Different classes of Pteridophytes	6	Specimens and Black Board
4.3	Stelar Evolution	3	Slides and BlackBoard
4.4	Apospory and Apogamy	3	PPT
4.5	Heterospory and Seed Habit	2	PPT
4.6	Economic Importance of Pteridophytes	1	PPT
5.1	Gymnosperms Classification – Sporne	2	Black Board
5.2	Different classes of gymnosperms	8	Specimens and Black Board
5.3	Male cone organization	3	PPT
5.4	Female cone organization	3	PPT
5.5	Economic Importance of Gymnosperms	2	PPT
TOTAL		**90**	

Thiagarajar College (Autonomous): Madurai – 625 009
Department of Botany
(For those joined M. Sc., Botany on or after June 2019)
Programme Code-PBO

Course Code	Course Title	Category	L	T	P	Credit
PBO19CL11	Thallophytes, Bryophytes, Pteridophytes andGymnosperms Lab	**Core Lab-1**		**-**	**6**	**4**

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

#	Course Outcome	Knowledge Level (according to Bloom's Taxonomy)
CO1	Classify various groups of plants	K1
CO2	Dissect and draw internal structures of different plant forms	K2, K4
CO3	Isolate fungi from different sources	K2
CO4	explain the ecological adaptations, internal organization and reproductive specialization of difnt plant groupsfere	K3
CO5	Analyze the fossil forms and the reasons for fossilization	K3,K5

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

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, MicrocystisandScytonema.*
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 pteridophyte 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*.

Thiagarajar College (Autonomous): Madurai – 625 009

Department of Botany

(For those joined M. Sc., Botany on or after June 2019)

Programme Code-PBO

Course Code	Course Title	Category	L	T	P	Credit
PBO19C12	**Plant cell and Molecular Biology**	**Core- 2**	**6**	**-**	**-**	**5**

Year	Semester	Int. Marks	Ext.Marks	Total
First	First	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 (according to Bloom's Taxonomy)
CO1	Know about microscopic techniques	K1
CO2	Comprehend nucleus and chromosomes	K2, K4
CO3	Explore about the genomes	K2
CO4	Recognize the gene expression in prokaryotes	K3
CO5	Enumerate the gene expression system in Eukaryotes	K3, K5

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

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	**60**	**60**	**150**

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: Euchromatinaand heterochromatin - polytene, lampbrush chromosome. Cell cycle. Cell division: Mitosis, Meiosis - Chiasma – Synoptemal complex. Nuclear DNA: Conformation-A, B, Z DNA. RNA conformation: t RNA, micro RNA, chloroplast and mitochondrial DNA. Cell signaling: Signal molecules, receptors, ligands, signaling pathways inplants.

Unit III: Genome: Replication of prokayotic and 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 – SOSresponse.

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

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,PS.,2006.CellBiologyGeneticsMolecularBiologyEvolutionAndEcology. 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.

Lecture Schedule

Unit	Topic	Lecture hrs.	Method
1.1	Microscopy – light, phase contrast microscopy, TEM, SEM,	4	Black Board
1.2	Flourescent and Confocal Microscopy. Cell: Ultra structure of plant cell.	4	Power Point
1.3	Cell wall: Primary structure – secondary structure. Plasma membrane: Fluid Mosaic model-properties.	4	Smart Board
1.4	Cytosol: cytoskeleton organisation. Cell organelles: – mitochondria –	3	Black Board
1.5	plastids – endoplasmic reticulum – Golgi complex, peroxisomes, ribosome.	3	Power Point
2.1	Nucleus: structure and function. Chromosome: Euchromatin and heterochromatin	6	Black Board
2.2	polytene, lampbrush chromosome. Cellcycle. Celldivision: Mitosis, Meiosis - ChiasmaSynaptonemal complex. Nuclear DNA:.	6	Power Point
2.3	Conformation-A, B, Z DNA. RNA conformation: t RNA, micro RNA, chloroplast and mitochondrial DNA	6	Group Discussion
3.1	Genome: Replication of prokayotic and eukaryotic DNA – enzymes involved – amplification and rearrangement –	6	Video lecture
3.2	Bacterial genetic recombination: conjugation, transformation, transduction. DNA damage – endogenous damage –	6	Power Point
3.3	oxidation –alkylation - methylation – exogenous damage - effects of UV radiation on DNA. DNA repair – base excision repair – mismatch repair – SOS response.	6	Power Point
4.1	Regulation of gene expression in Prokaryotes – gene architechture	6	Peer group Learning
4.2	promotor, regulator, structural genes and mechanism of action.	6	Black Board
4.3	Induction and repression – lac operon: negative control – positive control – CAP-cAMP method – trp repressible operon - attenuation and antitermination– ara operon	6	Black Board
5.1	Regulation of gene expression in Eukaryotes – mechanism of regulation – role of enhancers and silencers -.	6	Power point presentation
5.2	activation of transcription by steroid hormones- methylation -	6	Black Board
5.3	post transcriptional modification: capping, polyadenylation, pre-mRNA splicing- regulation of mRNA stability - Introns and Exons. Post translational modifications	6	Black Board
Total		**90**	

Thiagarajar College (Autonomous): Madurai – 625 009

Department of Botany

(For those joined M. Sc., Botany on or after June 2019)

Programme Code-PBO

Course Code	Course Title	Category	L	T	P	Credit
PBO19CL12	**Plant cell and Molecular Biology Lab**	**Core Lab- 2**		**-**	**6**	**4**

Year	Semester	Int. Marks	Ext.Marks	Total
First	First	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 (according to Bloom's Taxonomy)
CO1	Isolate genomic DNA from microbes and plants	K1
CO2	separate protein by electrophoresis	K2, K4
CO3	Show the different stages of mitosis	K2
CO4	Prepare the squashes of anthers	K3
CO5	Isolate antibiotic resistant colonies	K3, K5

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

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
CO5	**M**	**M**	**S**	**L**	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. Quantitative estimation of DNA by CTAB method
5. Agarose gel electrophoresis of chromosomal and plasmid DNA from *Escherichia coli*
6. Demonstration of PCR
7. Quantitative estimation of RNA
8. Electrophoretic separation of proteins
9. Mitosis cell division in onion root tips
10. Meiotic cell division in *Tradescantia* anthers
11. Isolation of antibiotic resistant bacterial mutants by gradient plate techniques
12. 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 2019)

Programme Code-PBO

Course Code	Course Title	Category	L	T	P	Credit
PBO19CE11	**Developmental Botany**	**Core Elective- 1**	**6**	**-**	**-**	**5**

Year	Semester	Int. Marks	Ext.Marks	Total
First	First	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 (according to Bloom's Taxonomy)
CO1	Explain the developmental process in plants	K1
CO2	Define morphogenesis and organogenesis in plants	K2, K4
CO3	Depict the fertilization and post-fertilization processes demonstrate development of fruit, seed, embryo and endosperm	K2
CO4	differentiate asexual method of embryo development from sexual means	K3
CO5	Comprehend nucleus and chromosomes	K3, K5

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

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

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	**60**	**60**	**150**

Unit I: Basic concepts of cell development: Potency, commitment, specification, induction,competence, determination and differentiation – morphogenetic gradients: polarity and symmetry – integration and organization of cells into tissues, tissues into organs, organs into whole plant – cytoplasmic determinants- programmed cell death – aging and senescence.

Unit II: **Morphogenesis and Organogenesis in plants:** Organization of root and shoot apicalmeristem – shoot and root development – leaf development and phyllotaxy – Transition from vegetative to reproductive phase: Morpho, histo and cytochemical changes in vegetative plant body floral meristems – floral development in *Arabidopsis* and *Antirrhinum.* Plant tumours-types and its development.

Unit III: Male and Female reproductive structure in flowers: Structure of androecium and gynoecium - Anther: Structure and development of anther, origin, structure and function of anther wall and tapetum, ultra structure and germination of pollen - Ovule: structure and development of ovule, types of ovule- female gametophyte: ontogeny, nutrition and morphology of embryo sac - pollen-pistil interaction.

Unit IV: Fertilization and Embryo Development: Fertilization–pollen entry - categories–physical, and biochemical changes during pollen entry – Double fertilization and triple fusion – Sexual incompatibility (SI) – Homomorphy and Heteromorphy; GSI and SSI – Genetic inheritance of SI – Methods to overcome SI - Endosperm: types, haustoria – Cellular, free nuclear and Helobial types; Ruminate endosperm, perisperm. Embryo: proembryo – Embryogeny – developmental types- dicot plant (*Capsella burapastoris*), monocot plant (*Luzula*)

Unit V: Fruit and Seed Development: Fruit: Pericarp structure–Fruit Development: Physical andBiochemical factors – Parthenocarpy: stimulative and vegetative parthenocarpy – Apomixis: Non-recurrent apomixis, recurrent apomixis, vegetative apomixes; Agamospermy and Polyembryony – types adventive embryony – seed structure and its development- Viviparous germination

Text Books:

Maheswari, P. 1985. An Introduction to the Embryology of the Angiosperm, Tata McGraw-Hill Publishing Company, New Delhi.

Burgess, J. 1985. An Introduction to Experimental and Applied Embryology of Angiosperms, Oxford and IBH Publishing Company, New Delhi.

Unit	Topics	Lecture Schedule (Hours)	Mode of Teaching/ Teaching aids
1.1	**Basic concepts of cell development:** Potency, commitment, specification, induction,competence, determination and differentiation	**3**	PPT and Google classroom
1.2	morphogenetic gradients: polarity and symmetry	**3**	google classroom
1.3	integration and organization of cells into tissues, tissues into organs, organs into whole plant	**4**	Illustrative teaching
1.4	Cytoplasmic determinants- programmed cell death	**4**	Google classroom
1.5	Aging and senescence	**4**	Illustrative teaching
2.1	**Morphogenesis and Organogenesis in plants:** Organization of root and shoot apicalmeristem	**3**	Black board
2.2	shoot and root development	**3**	Black board
2.3	leaf development and phyllotaxy – Transition from vegetative to reproductive phase: Morpho, histo and cytochemical changes in vegetative plant body	**4**	Black board
2.4	–- floral meristems – floral development in *Arabidopsis* and *Antirrhinum.*	**4**	Black board
2.5	Plant tumours-types and its development	**4**	Black Bard
3.1	**Male and Female reproductive structure in flowers:** Structure of androecium and gynoecium,	**3**	
3.2	- Anther: Structure and development of anther origin, structure and function of antherwall	**4**	
3.3	tapetum, ultra structure and germination of pollen	**4**	
3.4	- Ovule: structure and development of ovule, types of ovule-female gametophyte: ontogeny,	**4**	
3.5	Nutrition and morphology of embryo sac – PPI	**3**	
4.1	Fertilization and Embryo Development: Fertilization – pollen entry - categories – physical, and biochemical changes during pollen;entry	3	Black board
4.2	Double fertilization and triple fusion– Sexualincompatibility (SI) – Homo and Heteromorphy	4	Black board
4.3	GSI and SSI – Genetic inheritance– Methods to overcome SI -	4	Black board
4.4	Endosperm: types, haustoria – Cellular, free nuclear and Helobial types; Ruminate endosperm, perisperm.	4	Illustrative teaching
4.5	Embryo: proembryo – Embryogeny – developmental types- dicot (*Capsellaburapastoris*), monocot (*Luzula*)	3	Illustrative teaching
5.1	Fruit and Seed Development: Fruit: Pericarp structure	3	Black Board
5.2	Fruit Development: Physical and Biochemical factors	3	Black Board
5.3	Parthenocarpy: stimulative and vegetative	4	Black board
5.4	Apomixis: Non-recurrent apomixis, recurrent apomixis, vegetative apomixisAgamospermyPolyembryony –Types	4	Black board;
5.5	Seed structure and its development	4	Black Board
		90	

Thiagarajar College (Autonomous): Madurai – 625 009

Department of Botany

(For those joined M. Sc., Botany on or after June 2019)

Programme Code-PBO

Course Code	Course Title	Category	L	T	P	Credit
PBO19C21	Plant Biochemistry and Biotechniques	Core- 3	6	-	-	5

Year	Semester	Int. Marks	Ext.Marks	Total
First	Second	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 (according to Bloom's Taxonomy)
CO1	describe the structure & function of the Biomolecules.	K1
CO2	explain the enzyme kinetics	K2, K4
CO3	analyze different secondary metabolites	K2
CO4	depict the basic principles of Biotechniques.	K3
CO5	Demonstrate the application of Biotechniques.	K3, K5

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

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

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	**60**	**60**	**150**

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 – aminoacid breakdown – oxidative deamination. Protein: Biosynthesis of protein - formation of peptide bonds and polypeptide chain - – molecular configuration and conformation of proteins – Primary, secondary, tertiary and quaternary structures – properties and types of proteins –simple, complex and derived proteins.

Unit II: Enzymes: classification, kinetics, mechanism of enzyme action–Michaelis-Mentenconstant-Linewaever-Burk plot-Factors affecting enyme 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 - Chlorophylls,carotenoids, phycobilins anthocyanins and betacyanins– secondary metabolites – Alkaloids:biosynthesis, structure and function of quinine, atropine, colchicine. Structure and function of Triterpenoids.

Unit III: Plant Lipids: Classification of Lipids. Structure of triglycerids–Fatty acids,Phospholipids, Structure and function of Ergosterol and Cholesterol. Structure and function of Glyoxysomes, Glyoxalate cycle - β -Oxidation of fatty acids. Carbohydrates: Classification of Carbohydrates. Monosaccharides - Glycosidic bond. Physico-chemical properties of Mono, di and trisaccharides. Structure of Starch and Cellulose. Chemistry of Peptidoglycan.

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
Chromatograpy: 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, NewYork.

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 Fimch Puhlishers, Boston.

Wilson, K. and Walker, J. 2000. Practical Biochemistry- Principles and Techniques. Cambridge University Press, Cambridge, U.K..

Thiagarajar College (Autonomous): Madurai – 625 009

Department of Botany

(For those joined M. Sc., Botany on or after June 2019)

Programme Code-PBO

Course Code	Course Title	Category	L	T	P	Credit
PBO19CL21	Plant Biochemistry and Biotechniques Lab	Core Lab- 3		-	6	4

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 (according to Bloom's Taxonomy)
CO1	describe the principle of pH meter and pKa	K1
CO2	Find out the isoelectric pH of aminoacids and proteins	K2, K4
CO3	analyze different primary metabolites	K2
CO4	depict the basic principles of Biotechniques.	K3
CO5	Demonstrate the application of Biotechniques.	K3, K5

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

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

S:Strong M:Medium L: Low

Preparation of titration curve and pKa value determination.
Determination of isoionic pH of amino acid.
Determination of isoelectric pH of protein.
Estimation of protein content in legume.
Estimation of free amino acids content in plant source.
Estimation of soluble sugars content in plant source.
Estimation of anthocyanins.
Estimation of cholesterol content
Determination of saponification value of fat
Paper chromatographic identification of amino acids.
Effect of temperature on nitrate reductase/ amylase activity.
Effect of substrate concentration on nitrate reductase/ amylase activity.
Effect of pH on nitrate reductase / amylase activity
Effect of inhibitor concentration on nitrate reductase / amylase activity

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Department of Botany

(For those joined M. Sc., Botany on or after June 2019)

Programme Code-PBO

CourseCode	Course Title	Category	L	T	P	Credit
PBO19C22	**Microbiology Plant Pathology**	**Core-4**	**6**	**-**	**-**	**5**

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

Preamble

To equip the students with the basic principles of microbiology and Plant Pathology, updated methodologies, techniques applied aspects of Microbiology and Plant Pathology

Course Outcomes

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

#	Course Outcome	Knowledge Level (according to Bloom's Taxonomy)
CO1	Elucidatethe basic principles of microbiological innovations	K1
CO2	Demonstrate the production of various microbial culture medium	K3
CO3	Knowing the types of microorganism present in Soil and water	K1, K4
CO4	Detect the pathogens, disease and symptoms of various plant diseases	K2
CO5	Comprehend about the various disease control strategies	K3, K5

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

Mapping of COs with PSOs

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

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	**60**	**60**	**150**

Unit I: Brief history of microbiology, General account of microbes, Archaeobacteria, Eubacteriaand cyanobacteria. Prokaryotic and eukaryotic microbes, Whitaker's five kingdom concept - Classification (Bergey's manual of systematic Bacteriology). Bacteria: Ultra structure of bacteria-binnary fission. Viruses: general structure-classification-transmission-multiplication: T_4-bacteriophage, TMV and CMV.

Unit II: Sterilization techniques and different types of staining methods- Pure culture techniquesand 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 andsymbiosis. Microbial associations: Neutral, negative. Microbial fermentations - food contamination and its preservation. Aqautic microbiology-Microbes in fresh water and marine environment-Water borne pathogens and its infection-Water analysis-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). Defense 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: Blast disease of Paddy, wheat rust. C) Bacteria: Cotton blight, Citrus canker, d)Virus: Bhendi Yellow vein clearing virus, cucumber mosaic virus
e) Phytoplasma: Brinjal little leaf, *Sesamum* phyllody.

Text Books:

Prescott, L.M. and D.A.Harkey. 1996. Microbiology.Ww. C. Brown Publishers, London.Pommerville,

J.C.2006. Alcoma‖ s Fundamantals of Microbiology. Jones and Bertlett Publishers, London.

Atlas, R.M.1995. Principles of Microbiology. Morby Publishers, St. Louis.

Pelczer,M.,E.C.S.Chan nad N.R.Krieg.1993.Microbiology-concepts and Applications. Tata Mc-Graw Hill Ltd., Inc., NewYork.

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.

Mehrotra, R.S.1980. Plant Pathology. Tata McGraw-Hill Publishing Company Ltd., New Delhi.

Pandey, B.R.1997. Plant Pathology. S. Chand and company, New Delhi.
Agrios,G.N. 2006. Plant Pathology, Fifth Edition, Academic Press, New York.
Detection and diagnosis of plant diseases. M.L. Gullinio, spinger, 2014

Reference Books:

Alexopolus, C.J. and Mims, C.W.1979. Introductory Mycology. III Edition. Wiley Eastern Ltd. New Delhi.

Rengasamy, G. 1979. Disease of crop plants in India. III edi., Prentice Hall of India, Pvt Ltd,New Delhi.

Prescott, L.M., Harley , J.P. nad Klein, P.A. 1993. Microbiology. W.M.C. Brown publishers, IOWA, USA.

Patel, A.H. 1985. Industrial Microbiology, Macmillan India Ltd. New Delhi.

Purohit, S.S.1995. Microbiology-Fundamantals and applications, V Ed. Agrobotanical Publishers, Bikaner.

Course designers

Dr. B. Sadhana
Dr. V.Karthikeyan

Lecture Schedule

Unit	Topic	Lecture hrs	Method
1.1	Brief history of microbiology, General account of microbes, Archaeobacteria,	3	Black Board
1.2	Eubacteria and cyanobacteria. Prokaryotic and eukaryotic microbes, Whitaker's five kingdom concept -	4	Power Point
1.3	Classification (Bergey's manual of systematic Bacteriology). Bacteria:	4	Smart Board
1.4	Ultra structure of bacteria-binnary fission. Viruses: general structure.	4	Black Board
1.5	classification-transmission-multiplication: T4-bacteriophage, TMV and CMV	3	Power Point
2.1	Sterilization techniques and different types of staining methods- Pure culture techniques and culture preservation.	6	Black Board
2.2	Microbial nutrition: nutritional groups and Culture media-types. Microbial growth curve and measurement of growth by cell numbers and cell mass-	6	Power Point
2.3	Factors influencing growth - Continuous growth	6	PPT
3.1	Soil microbiology: Microbial interactions-Mutualism, Commensalism, Parasitism and symbiosis.	6	Black Board
3.2	Neutral, negative. Microbial fermentations - food contamination and its preservation. Aqautic microbiology-	6	Power Point
3.3	Microbes in fresh water and marine environment-Water borne pathogens and its infection-Water analysis-Waste water treatment, Biomining – biofilms - superbugs.	6	Power Point
4.1	Principles and concepts in phytopathology- classification of plant diseases based on symptoms, Early detection and diagnosis of plant diseases. Infection process:.	6	Peer group Learning
4.2	Mode of Entry of pathogen-establishment of pathogen (enzymes and toxins). Defense mechanism: Structural and biochemical. Epidemiology:	6	Black Board
4.3	Forms of epidemics, conditions governing epidemics, reasons for progressive severity of epidemics and decline of epidemics-concept of post harvest diseases and its management	6	Interactive learning
5.1	Plant Disease Control methods: Cultural practices, Quarantine, Chemical control	6	Black Board
5.2	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: Blast disease of Paddy, wheat rust. C) Bacteria: Cotton blight, Citrus canker	6	Video lecture
5.3	d)Virus: Bhendi Yellow vein clearing virus, cucumber mosaic virus e) Phytoplasma: Brinjal little leaf, Sesamumphyllody	6	Black Board
Total		**90**	

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Department of Botany

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Programme Code-PBO

Course Code	Course Title	Category	L	T	P	Credit
PBO19CL22	Microbiology Plant Pathology Lab	Core Lab-4		-	6	4

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

Preamble

To equip the students with the basic principles of microbiology and Plant Pathology, updated methodologies, techniques applied aspects of Microbiology and Plant Pathology

Course Outcomes

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

#	Course Outcome	Knowledge Level (according to Bloom's Taxonomy)
CO1	Isolate bacteria and fungi from different sources	K1
CO2	Show the motility of bacteria	K3
CO3	Identify bacteria and fungi	K1, K4
CO4	Explain the growth kinetics of bacteria	K2
CO5	Identify different plant diseases	K3, K5

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

Mapping of COs with PSOs

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

S:Strong M:Medium L: Low

1 . Preparation of media and pure culture technique.
2 . Staining methods: Acid fast staining,Gramstaining,Negative staining, Endospore staining and Staining of poly - β 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 bactreiophages from sewage.
9. Isolation of Rhizobium and Frankia from the nodules.
10. Isolation of plant pathogens from infected p lant materials.
11. Isolation of AM spores by wet sieving - decanting method.
12. Study of diseased materials - Rust by Puccinia .
13. Red rust and White rust.
14. Leaf spot of ground nut.
15. Canker and Red rot.
16. Collection of plant pathology specimens –10 sheets to be valued externally.

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Department of Botany

(For those joined M. Sc., Botany on or after June 2019)

Programme Code-PBO

Course Code	**Course Title**	**Category**	**L**	**T**	**P**	**Credit**
PBO19CE21	Computer Applications in Biology and Biostatistics	Core Elective -2	**6**	**-**	**-**	**5**

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

Preamble

To acquire knowledge to apply recent developments in the field of biology

Course Outcomes

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

#	Course Outcome	Knowledge Level (according to Bloom's Taxonomy)
CO1	Recognize various applications of computers in biology	K1
CO2	Perform basic statistical analysis of any data	K2
CO3	Apply appropriate statistical tool in the problem solving	K3
CO4	Acquire talents and skills on basics and advance level computational biostatics to their research projects	K3, K4
CO5	Evaluate the tools and programmes of biorinformatics in their research	K5

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

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

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	**60**	**60**	**150**

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.

U**nit II:** –Nucleotide Sequence databases: DDBJ, Protein sequence databases: SWISS PROT–Pairwise sequence alignment – FASTA and BLAST, Multiple sequence alignment. Secondary and composite databases- SCOP. Protein structure databases: PDB. Homology Modelling, Phylogeny Tree Analysis – Treeview and Phylip

Unit III. Biostatistics–Scope and application. Data collection and SamplingMethods–Meritsand 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–Formulawith 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

Uni**it V:** Probability theory–Basic concept - Probability distributions: Binomial, Poisson andNormal – Problems with solving procedure - Applications, ANOVA – Principle – One-way, Two-way and MANOVA methods – Comparison of means: LSD and DMRT - Problems with solving methods – Applications in Biological research.

T**ext Books:**

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, Ukazsz Publications, Hyderabad, India, 2004

Reference Books:

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, Ukazsz Publications, Hyderabad, India
5. Zar, J.K. 2011. Bio statistical Analysis, Fourth Edition, Prantice-Hall International, New Jersey, USA.

Course Designers:

1. **Dr. D. Kannan**
2. **Dr. M. Viji**
3. **Dr. K. Saraswathi**
4. **Dr. K. Sathiya Dash**

Lecture Schedule

Unit	Topic	Lecture hrs.	Method
1.1	Computer Introduction	3	Black Board, Demonstration
1.2	Operating Systems	3	PPT
1.3	Search Engines	3	PPT
1.4	Basic Bioinformatics Tools	3	PPT and Demonstration
1.5	Data bases	3	PPT and Demonstration
1.6	Retrieval system	3	Demonstration
2.1	Nucleotide and Protein Sequence alignment	4	PPT and Demonstration
2.2	Pairwise and Multiple sequence alignment	4	PPT and Demonstration
2.3	Primary and composite data bases	3	PPT and Demonstration
2.4	Protein structure data bases	3	PPT and Demonstration
2.5	Phylogenetic analysis	4	PPT and Demonstration
3.1	Data collection and sampling	3	Black Board
3.2	Measures of central tendency	4	Black Board
3.3	Measures of dispersion	4	Black Board
3.4	Excel	3	PPT and Demonstration
3.5	SPSS	4	PPT and Demonstration
4.1	Correlation	4	Black Board and Demonstration
4.2	Regression	4	Problem description and solving method; ICT tool application
4.3	Hypothesis testing	4	Demonstration
4.4	Test of significanceand Applications in biology	4	Black Board and Demonstration; Play Game and ICT Method
4.5	Test of significance – methods and applications in biology	2	Play Game and ICT Method
5.1	Probability and Distribution	4	Black Board and Demonstration
5.2	ANOVA	4	Black Board and Demonstration
5.3	MANOVA	4	Black Board and Demonstration
5.4	Mean comparison test	4	Black Board and Demonstration
5.5	Applications of ANOVA in biology	2	Demonstration, ICT method
TOTAL		**90**	

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Department of Botany

(For those joined M. Sc., Botany on or after June 2019)

Programme Code-PBO

Course Code	Course Title	Category	L	T	P	Credit
PBO19C31	**Angiosperm Taxonomy**	**Core-5**	**6**	**-**	**-**	**5**

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

Preamble

To equip the students with the basic principles of methodologies, techniques applied aspects of Angiosperm taxonomy.

Course Outcomes

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

#	Course Outcome	Knowledge Level (according to Bloom's Taxonomy)
CO1	Expound the classification of Angiospermic plants	K1
CO2	Recognize the nomenclature, principles and typification concepts	K2, K4
CO3	Key features identification of polypetalaefamilies	K3, K5
CO4	Characterization and economic importance of Gamopetalae	K3, K5
CO5	Key features of monochlamydeae and monocotyledons	K3, K5

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

Mapping of COs with PSOs

	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	**M**	**S**	**S**	**L**
CO2	S	**M**	**S**	**L**	**L**
CO3	**L**	**M**	**S**	**L**	S
CO4	**L**	**S**	**L**	**M**	S
CO5	**S**	**L**	**M**	**M**	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	**60**	**60**	**150**

Unit I: Angiosperm classification: Basic principle, outline, merits and demerits for the following Systems: Bentham and Hooker, Charles E. Bessey, Engler and Prantl and Hutchinson. Angiosperm Phylogeny group (APG III, 2009 and updated APG IV 2016): Features, merits and demerits

Unit II: ICBN–Nomenclature Principles–Nyms concept: Synonym, Homonym, Tautonym–Principle of priority – Effective and valid publication – Author citation – Retention and rejection of names; Typification concept and application; Chemotaxonomy and numerical taxonomy – DNA bar coding – Taxonomy data bases

Unit III: Key family characters, floral characters, floral variations, affinities with other familiesand economic importance of the following families, grouped under Polypetalae of dicotyledons: Magnoliaceae, Nymphaceae, Capparidaceae, Sterculiaceae, Sapindaceae, Zygophyllaceae, Rhamnacaeae, Combretaceae, Aizoaceae, Passifloraceae

Unit IV: Key family characters, floral characters, floral variations, affinities with other familiesand economic importance of the following families, grouped under Gamopetalae of dicotyledons: Rubiaceae, Asteraceae, Apocynaceae, Gentianceae, Boraginaceae, Bignonaceae, Scrophulariaceae, Verbenaceae

Unit V: Key family characters, floral characters, floral variations, affinities with other families andeconomic importance of the following families, grouped under Monochlamydeae of Dicots and Monocotyledonous families: Nyctaginaceae, Piperaceae, Loranthaceae, Euphorbiaceae, Typhaceae, Commeliniaceae, Araceae, Cyperaceae

Text Books:

Vasishta, P.C.1992. Taxonomy of Angiosperms, R.Chand and Co., New Delhi.
Lawrence, G.H.M. 1951. Taxonomy of vascular plants. The Macmillion Co., New York.
Heywood, V.K. 1967. Plant Taxonomy Edward Arnold Pub.. Ltd. London.
Rendle, A.B. 1925. The classification of flowering plants. Vol II Dicotyledons. Cambridge University Press. London.

Reference Books/Research Articles:

Simpson, M.G. 2006. Plant Systematics, Academic Press, UK.
Pulliah, T. 2007. Taxonomy of Angiosperms, Third Edition, Regency Publication, New Delhi
Johri, R.M. 2005. Taxonomy, Vol. I to V, Sonali Publication, New Delhi.
Battacharyya, B. 2005. Systematic Botany, Narosa Publishing House, New Delhi
Angiosperm Phylogeny Group, 2009. An update of the Angiosperm Phylogeny Group classification for the orders and families of flowering plants: APG III , *Botanical Journal of theLinnean Society,* **161**(2): 105–121, doi:10.1111/j.1095-8339.2009.00996

Course Designers:

Dr.E.Mohan
Dr.R.Aruna

Lecture Schedule

Unit	Topic	Lecture hrs.	Method
1.1	Angiosperm classification: Basic principle, outline, merits and demerits for the following Systems: Bentham and Hooker,	4	Black Board
1.2	Charles E. Bessey,	4	Power Point
1.3	Engler and Prantl and Hutchinson.	4	Smart Board
1.4	Angiosperm Phylogeny group (APG III, 2009 and updated APG IV 2016):	3	Black Board
1.5	Features, merits and demerits	3	Power Point
2.1	ICBN – Nomenclature Principles – Nyms concept:	6	Black Board
2.2	Synonym, Homonym, Tautonym – Principle of priority – Effective and valid publication. Author citation – Retention and rejection of names; Typification concept and application;	6	Power Point
2.3	Chemotaxonomy and numerical taxonomy – DNA bar coding – Taxonomy data bases	6	Group Discussion
3.1	Key family characters, floral characters, floral variations, affinities with other families and economic importance of the following families, grouped under Polypetalae of dicotyledons: Magnoliaceae, Nymphaceae,	6	Video lecture
3.2	Capparidaceae, Sterculiaceae, Sapindaceae,	6	Power Point
3.3	Zygophyllaceae, Rhamnacaeae, Combretaceae, Aizoaceae, Passifloraceae	6	Power Point
4.1	Key family characters, floral characters, floral variations, affinities with other families and economic importance of the following families, grouped under Gamopetalae of dicotyledons: Rubiaceae,	6	Peer group Learning
4.2	Asteraceae, Apocynaceae, Gentianceae,	6	Black Board
4.3	Boraginaceae, Bignonaceae, Scrophulariaceae, Verbenaceae	6	Black Board
5.1	Key family characters, floral characters, floral variations, affinities with other families and economic importance of the following families, grouped under Monochlamydeae of Dicots and Monocotyledonous families: Nyctaginaceae, Piperaceae,	6	Power point presentation
5.2	Loranthaceae, Euphorbiaceae, Typhaceae,	6	Black Board
5.3	Commeliniaceae, Araceae, Cyperaceae	6	Black Board
Total		**90**	

Thiagarajar College (Autonomous): Madurai – 625 009

Department of Botany

(For those joined M. Sc., Botany on or after June 2019)

Programme Code-PBO

Course Code	Course Title	Category	L	T	P	Credit
PBO19CL31	**Angiosperm Taxonomy Lab**	**Core Lab-5**		**-**	**6**	**4**

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

Preamble

To equip the students with the basic principles of Angiosperm taxonomy, methodologies, techniques applied aspects of Angiosperm taxonomy.

Course Outcomes

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

#	Course Outcome	Knowledge Level (according to Bloom's Taxonomy)
CO1	Identify and explain in technical terms of the plants of polypetalae families	K1
CO2	Characterize the plants of Gamopetalae	K2, K4
CO3	Explain key features of monochlamydeae and monocotyledons	K3, K5
CO4	Prepare yoked and indented key for plant identification	K3, K5
CO5	To prepare herbarium sheets	K3, K5

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

Mapping of COs with PSOs

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

S:Strong M:Medium L: Low

1) Identification of the family for the given fresh plant specimen by describing the key morphological and floral characters with diagrams and constructing the floral formula of Plants belong to Polypetalae of Dicots:
Magnoliaceae, Nymphaceae, Brassicaceae, Sterculiaceae, Sapindaceae, Zygophyllaceae, Rhamnacaeae, Combretaceae, Aizoaceae, Passifloraceae

Plants belong to Gamopetalae of Dicots: Rubiaceae, Asteraceae, Apocynaceae, Gentianceae, Boraginaceae, Bignonaceae, Verbanaceae

Plants belong to Monochlamydeae of Dicots, and Moncot s: Nyctaginaceae, Piperaceae, Loranthaceae, Euphorbiaceae, Typhaceae, Commeliniaceae, Araceae, Cyperacaeae

2) Preparation of Yoked and Indent keys for the given plants to group them into genus level taxon

3) Identification of the given fresh plants using Gam ble's flora - ‗Presidency of Madras' (3 Vol.)

4) Identification of the family for a given fresh plant specimen, using Punch Cards

5) Solve the taxonomic problem, based on ‗Nym' concept

6) Identify the binomial for the given two fresh plant specimens/herbarium specimens

7) Submission of i) Records, ii) Field observation note and iii) minimum of 20 Herbarium sheets stacked with the dried plant specimen with appropriate identification label for external evaluation.

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Department of Botany

(For those joined M. Sc., Botany on or after June 2019)

Programme Code-PBO

Course Code	Course Title	Category	L	T	P	Credit
PBO19C32	**Plant Physiology**	**Core-6**	**6**	**-**	**-**	**5**

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

Preamble

To equip the students with the basic principles of plant physiology, mechanisms and hormones involved pre and post reproduction

Course Outcomes

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

#	Course Outcome	Knowledge Level
CO1	Demonstratethe principleinvolved in ascent of sap in plants	K1
CO2	Examine the plant cellular metabolism	K2
CO3	Relate the physiological functional analysis and plant growth with relevance to plant growth regulators	K3
CO4	Apply the acquired knowledge in solving the problems with relevance to dormancy, senescence and fruiting in plants	K3, K4
CO5	Analyze the stress related growth and functions in plants	K2, K5

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

Mapping of COs with PSOs

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

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	**60**	**60**	**150**

Unit I: Water movement in plants: Mechanism of absorption of water – apoplast and symplast concept – Ascent of sap – SPAC concept. Transpiration: Stomatal physiology and mechanism – Transpiration and guttation. Mineral nutrition and its deficiency symptoms in plants-Absorption of mineral salts – mechanism. Mechanism of organic solute transport: pressure flow mechanism, phloem loading and unloading.

Unit II: Photosynthesis: Chloroplast and Pigment systems in Photosystem I and Photosystem II – light reaction – Z – scheme of photosynthetic electron transport chain and photophosphorylation – Carbon assimilation C3, C4 and CAM pathways – Photorespiration and its significance. Respiration: Mitochondria and its functions-Glycolysis and TCA cycle – Oxidative Phosphorylation – alternative respiration (Cyanide) – HMP pathway-Nitrogen, Phosphorus and sulphur metabolism.

Unit III: Plant hormones: Structure, Physiological role and mode of action (in brief) of Auxins, Gibberellins, Cytokinis, Ethylene, Abscisic acid and Brassinosteroids – Growth retardants – polyamines, and morphactins. Phytochromes: Photochemical and biochemical properties, photomorphogenetic effects, mode of action. Flowering :Photoperiodism and its significance, - Short day, long day and day neutral plants – regulation of flowering – Vernalization .

Unit IV: Dormancy: Seed, bud, and tuber dormancy. Seed germination – hormonal regulation of germination and dormancy. Senescence : Physiology of senescence, delay of senescence – Fruiting– mechanism of fruiting –role of ethylene- hormonal control of fruiting and storage of fruits.

Unit V: Stress Physiology : Classification of stress – response of plants to salt, heavy metals, drought, freezing, heat, oxidative and UV stresses – mechanism of stress resistance. Biological rhythms: Endogenous clock mechanism – Circadian rhythm.

Text Books:

1. Kumar, A. and S.S.Purohit. 2005. Plant physiology, Agrobios (India), Jodhpur.
2. Mukherji S. and A.K. Ghosh. 2005. Plant Physiology, First Central Edition. New Central Book Agency (P) Ltd., Kolkata.
3. Noggle, G.R. and G.J. Fritz. 1986. Introductory Plant Physiology. Prentice – Hall India Pvt. Ltd., New Delhi.
4. Taiz. L. and E. Zeiger. 2003. Plant Physiology, Third Edition, Panima Publishing Corporation, New Delhi.
5. Salisbury, F.B. and C.N. Ross. 2003. Plant physiology, CBS Publishers and Distributors, New Delhi.

References:

1. Bidwell, R.G.S., 1979. Plant Physiology, Second Edition, McMillan Publishers, New York.
2. Goodwin, F.W. and F.I. Mercer. 1983. Introduction to Plant Biochemistry, Second Edition, Pergamon Press, New York.
3. Wilkins, M.B. 1984. Advanced Plant Physiology, Pitman Publication Limited, London.
4. Hopkins, W.G. 1995. Introduction to Plant Physiology. John Wilery& Sons Inc., USA.
5. Zeiger, L.T.E. 2010. Plant physiology, Sinauer Associates, UK.
6. Nobel, P.S. 2009. Physicochemical and Environmental Plant Physiology, Fourth Edition. Academic press, U.K.

Course designer

1. Dr. B. Sadhana

Lecture Schedule

Unit	Topic	Lecture hrs.	Method
1.1	Water movement in plants	5	PPT, animation
1.2	Concept of Transpiration	5	Black Board
1.3	Mechanism of mineral absorption and transport	5	Smart Board
2.1	Photosynthesis	10	PPT, animation
2.2	Respiration	10	PPT, animation
3.1	Structure, Physiological role and mode of action of Plant hormones	15	Black Board
3.2	Photochemical and biochemical properties, photomorphogenetic effects, mode of action of Phytochromes	5	Power Point
3.3	Mechanism of Flowering	5	Black Board, Group Discussion
4.1	Types of dormancy and senescence	5	Black Board
4.2	hormonal regulation of germination	5	Power Point
4.3	Mechanism and storage of fruiting	5	Power Point
5.1	Classification and mechanism of Stress Physiology	10	Peer group Learning
5.2	Biological rhythms: Endogenous clock mechanism – Circadian rhythm.	5	Black Board
Total		**90**	

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Department of Botany

(For those joined M. Sc., Botany on or after June 2019)

Programme Code-PBO

Course Code	Course Title	Category	L	T	P	Credit
PBO19CL32	**Plant Physiology Lab**	**Core Lab-6**		**-**	**6**	**4**

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

Preamble

To equip the students with the basic principles of plant physiology, mechanisms and hormones involved pre and post reproduction

Course Outcomes

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

#	Course Outcome	Knowledge Level (according to Bloom's Taxonomy)
CO1	Demonstratethe principle involved in ascent of sap in plants	K1
CO2	Estimate the pigment contenys in leaves	K2
CO3	Find out the stomatal frequency	K3
CO4	Calculate the proline contents in stressed plants	K3, K4
CO5	Analyze the absorption spectrum of plant pigments	K2, K5

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

Mapping of COs with PSOs

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

S:Strong M:Medium L: Low

Water potential by gravimetric method.

Water potential by falling drop method.

Osmotic potential by plasmolytic method.

Quantitative estimation of total chlorophyll content in leaves.

Quantitative estimation of carotenoid content in flowers

Absorption spectrum of chlorophylls and Action spectrum of Photosynthesis

Absorption spectrum of β – carotene.

Effect of temperature on membrane permeability

Effect on detergent on membrane permeability

Estimation of proline content in normal and senescent leaves

Determination of nitrogen content in roots and root nodules

Measurement of Stomatal Index

Measurement of Stomatal area

Mesophyll cell isolation and chlorophyll fluorescence

UV-B effect on nitrate reductase activity (Stress activity)

Differentiation of $C_3$and C_4 plants by starch test.

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Department of Botany

(For those joined M. Sc., Zoology on or after June 2019)

Programme Code-PBO

Course Code	Course Title	Category	L	T	P	Credit
PBO19ID31	**Plant Tissue Culture**	**Elective – 3 Inter-Disciplinary Course**	**6**	**-**	**-**	**5**

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

Preamble

To equip the students with the basic principles of plant tissue culture

Course Outcomes

Upon successful completion of the course students will be able to

#	Course Outcome	Knowledge Level (according to Bloom's Taxonomy)
CO1	explain the basic principles and techniques in tissue culture	K1
CO2	perform various techniques employed in plant tissue culture	K2
CO3	do anther culture and produce haploids	K2, K4
CO4	depict the production of alkaloids	K2, K5
CO5	analyse the various conservation practices	K3, K5

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

Mapping of COs with PSOs

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

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	**60**	**60**	**150**

Unit I: History of plant cell and tissue culture, Culture media, The concept of Pluripotency of cells, various types of cultures: callus, cell suspension, root, meristem, In vitro culture: physical, genetic,chemical and genotypic factors, In vitro differentiation: Organogenesis and somatic embryogenesis, Assessment of growth and development in vitro, Problems in plant tissue culture (Recalcitrance, Contamination, Phenolic browning, and Seasonal variation.

Unit II: Molecular basis of plant organ differentiation: Micropropagation-plant multiplication, hardening, transplantation, genetic fidelity, scales up and cost reduction, bioreactor, artificial seeds, Applications of tissue culture, In vitro pollination and fertilization, Embryo rescue.

Unit III: Androgenesis, Anther and pollen culture, Gynogenesis, ovule and ovary culture, dihaploids and their applications in genetics and plant breeding, Protoplast isolation and purification, Protoplast viability test, Protoplast culture and regeneration, Somatic hybridization - methods and applications, Cybrids, Somaclonal and gametoclonal variations, In vitro selection.

Unit IV: Large scale production of alkaloids and other secondary metabolites through cell culture techniques, high yielding cell lines, factors affecting production, Biotransformation, Hairy root culture and production of secondary metabolites, Immobilization of plant cells.

Unit V: Plant Genetic resources, Germplasm conservation and cryopreservation, Cryoprotectants, Gene bank, Transgenic plants, Selectable marker genes and their uses.

Text books:

1.Smith, R. H.1992. Plant Tissue Culture: Techniques and Experiments, Academic Press, San Diego.
2.Gupta, P. K . 2000. Elements of Biotechnology, Rastogi Publications, Meerut.
3.Dubey, R .C. 2001. A text book of biotechnology, S Chand & Co., New Delhi.
4.Ignacimuthu, S. J. 2003. Plant Biotechnology, Oxford & IBH Publishing, New Delhi.
5.JohnJothi Prakash, E.2005. Outlines of Plant Biotechnology,Emkay Publishers, New Delhi
6.Kalyankumar De, 2008. Plant tissue culture, New Central Book Agency, Calcutta.

Reference books:

1.Bhojwani, S. S. and M. K. Razdan. 2004. Tissue Culture: Theory and Practice, Elsevier, New Delhi.
2.Purohit, S. S. 2010. Plant tissue culture, Student edition, S.S. Publication, Jodhpur.
3.Smith, R. 2012. Plant Tissue Culture, Techniques and Experiments, Third Edition, Academic Press, San Diego.
4.Bhojwani, S. S. and P.K. Dantu. 2013. Plant Tissue Culture: An Introductory Text, Springer, India.

Course Designers:

1. Dr.M.Viji
2. Dr.K.Sathiyadash
3. Dr.K.Saraswathi

Lecture Schedule

	Topic	**No of Lecture hrs.**	
1.1	History of plant tissue culture, Culture media	4	
1.2	The concept of totipotency of cells, various types of cultures: callus, cell suspension, root, meristem	4	
1.3	*In vitro* culture: physical, genetic,chemical and genotypic factors, differentiation	4	
1.4	In vitro : Organogenesis and somatic embryogenesis, Assessment of growth and development in vitro	3	
1.5	Problems in plant tissue culture (Recalcitrance, Contamination, Phenolic browning, & Seasonal variation.	3	
2.1	Molecular basis of plant organ differentiation: Micropropagation-plant multiplication,	3	Black board
2.2	Hardening, transplantation, Genetic fidelity	4	Black board
2.3	Scales up and cost reduction	3	Black board
2.4	Bioreactor, artificial seeds, Applications of tissue culture	4	Power point
2.5	*In vitro* pollination and fertilization, Embryo rescue.	4	Black board
3.1	Androgenesis, Anther and pollen culture, Gynogenesis, ovule and ovary culture	4	Black Board
3.2	Dihaploids and their applications in genetics and plant breeding,	4	Group Discussion
3.3	Protoplast isolation and purification, Protoplast viability test,	3	Black Board
3.4	Protoplast culture and regeneration	3	Demonstration
3.5	Somatic hybridization - methods and applications, Cybrids, Somaclonal and gametoclonal variations, In vitro selection.	4	PPT
4.1	Large scale production of alkaloids and other secondary metabolites through cell culture techniques,	5	PPT
4.2	High yielding cell lines, factors affecting production	3	Black Board
4.3	Biotransformation	3	PPT
4.4	Hairy root culture and production of secondary metabolites,.	4	PPT
4.5	Immobilization of plant cells	3	Demonstration
5.1	Plant Genetic resources	3	Black Board
5.2	Germplasm conservation	4	Black Board
5.3	Cryopreservation and Cryoprotectants	4	Black Board
5.4	Gene bank and Transgenic plants	4	Black Board
5.5	Selectable marker genes and their uses	3	Black Board
		90	

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Department of Botany

(For those joined M. Sc., Botany on or after June 2019)

Programme Code-PBO

Course Code	Course Title	Category	L	T	P	Credit
PBO19C41	**Plant Biotechnology**	**Core-7**	**6**	**-**	**-**	**5**

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

Preamble

To equip the students with the basic principles of plant biotechnology, industrial biotechnology and agricultural biotechnology

Course Outcomes

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

#	Course Outcome	Knowledge Level
CO1	Perform the techniques involved in plant genetic engineering	K1
CO2	explain the transgenic plants	K2
CO3	Perform plant tissue culture experiments	K3
CO4	apply the knowledge of biotechnology in exploitation of plants for human welfare	K3, K4
CO5	Analyze the use of microbes in industry	K2, K5

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

Mapping of COs with PSOs

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

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	**60**	**60**	**150**

Unit I: Genetic Engineering: Scope, applications and limitations. Tools: Type-I, II and III Restriction Endonucleases, Modification Methylases, Alkaline phosphatases, Ligases, Reverese transcriptases. Vector: Plasmid and Bacteriophage vectors. Transformation Techniques: Transformation, transduction and Conjugation. Selection of recombinant clones: Insertional inactivation and Replica plating .

Unit II: Plant Biotechnology: Plant Tissue culture: Totipotency and plasticity, Media preparation (MS medium), Applications of plant tissue culture, Explants preparation, Culture types: Callus culture , suspension culture, Meristem culture, Anther and Embryo culture , Micropropagation, Organogenesis. Somatic hybridization, Somatic embryogenesis, protoplast isolation and protoplast fusion and Germplasm conservation.

Unit III: Agricultural Biotechnology: Transgenic plants: Diseases resistance- Bt Cotton, strain improvement –, Golden rice. Molecular farming: Plantibodies, Edible Vaccines, Bioplastics. Biofertilizers: Mass cultivations and application of nitrogenous and phosphatic biofertilizers. Applications of Biotechnology in crop improvement: Antisense RNA Technology, Terminator seed Technology – Role of MNCs in Agribusiness.

Unit IV: Industrial Biotechnology: Fermentor- Structure, Design and Types - Microbial fermentation process: Production of industrial alcohol, wine, beer. Production of Amino acids - Glutamic acid, Production of organic acids- Citric acid, Production of Industrial enzymesAmylases and proteases. Production of Antibiotics- Penicillin, Streptomycin. Bacterial biomassLactobacillus, Spirulina for Single cell protein.

Unit V: Environmental Biotechnology: Biodegradation and Bioconservation. Biomass and Bioenergy: Petrocrops (Euphorbia, Hevea rubber, Algal hydrocarbons), Gasification, pyrolysis. Biofuels: Photobiological hydrogen production. Biogas: Models of biogas plants, Mechanisms and techniques of biogas production, Bio dyes. Sewage and effluent treatment: Activated sludge treatment

Text books:

1. Kumar H.D. 2001. A textbook on Biotechnology. East-west Press, New Delhi.
2. Dubey, R.C.2002. A textbook of Biotechnology. S. Chand and Company, New Delhi.
3. Ignacimuthu, S.J. 1997. Plant Biotechnology. Oxford and IBH Publishing Company, New Delhi.
4. Nirmala,C.B., G. Rajalakshmi, Chandra Karthick. 2009. Plant Biotechnology. MJP publishers, Chennai
5. Singh,R. 2011. ―Plant Biology and Biotechnology‖ , Educational Publishers and Distributors, New Delhi.
6. Smith , R. H . 2000 ―Plant Tissue Culture - Techniques and Experiments‖ , Academic Press, New York.
7. Trivedi, P.C. 2010. ―Plant Tissue Culture and Biotechnology‖ , Second Edition, Pointer Publication, Jaipur. 915
8. Rana, S.V.S. 2012. ―Biotechnology-Theory and practical‖ , Third Edition, Elective Press, Meerut.
9. Gupta, P. K . 2000. Elements of Biotechnology, Rastogi Publications, Meerut.

Reference books:

1. Subba Rao, N.S. 2001. Soil Microbiology, Oxford and IBH Publishing Company, New Delhi

2. Yeoman, J.R.M.M. 1982. Cell and Tissue culture, Narosa Publishing House. New Delhi

3. Chawla, H.S. 2008. Introduction to plant Biotechnology. Oxford & IBH publishing co., Pvt.Ltd. New Delhi.

4. Glick, B.R. and J.J. Pasternak. 2003. Molecular Biotechnology – Principles and Applications of Recombinant DNA, Third Edition, ASM Press, Washington, USA

5. Primrose, S., R.Twyman and P.Old.2005. Principles of Gene Manipulation, Blackwell Science Ltd, Oxford.

Lecture Schedule

Unit	Topic	Lecture hrs.	Method
1.1	Genetic Engineering: Scope, applications and limitations	3	Black Board
1.2	Tools: Type-I, II and III Restriction Endonucleases, Modification Methylases, Alkaline phosphatases, Ligases, Reverese transcriptases	3	PPT
1.3	Vector: Plasmid and Bacteriophage vectors	4	PPT
1.4	Transformation Techniques: Transformation, transduction and conjugation	4	PPT
1.5	Selection of recombinant clones: Insertional inactivation and Replica plating	4	PPT
2.1	Plant Tissue culture: Totipotency and plasticity, Media preparation (MS medium), Applications of PTC	4	Black Board
2.2	Explants preparation, Culture types: Callus culture , suspension culture, Meristem, Anther and Embryo culture	4	Black Board
2.3	Micropropagation, Organogenesis	4	Black Board
2.4	Somatic hybridization	3	PPT
2.5	Somatic embryogenesis, protoplast isolation and protoplast fusion and Germplasm conservation	3	Black Board and Practical demonstration
3.1	Agricultural Biotechnology: Transgenic plants: Diseases resistance- Bt Cotton,	4	Black Board
3.2	strain improvement –, Golden rice. Molecular farming: Plantibodies, Bioplastics, Edible Vaccines	8	Black Board
3.3	Biofertilizers: Mass cultivations and application of nitrogenous and phosphatic biofertilizers	3	PPT
3.4	Applications of Biotechnology in crop improvement: Antisense RNA Technology, Terminator seed Technology – Role of MNCs in Agribusiness	3	PPT
4.1	Fermentor- Structure, Design and Types -	3	PPT
4.2	Microbial fermentation process: Production of industrial alcohol, wine, beer.	3	Discussion
4.3	Production of Amino acids - Glutamic acid, Production of organic acids- Citric acid,	3	Discussion
4.4	Production of Industrial enzymesAmylases and proteases. Production of Antibiotics- Penicillin, Streptomycin	6	Discussion
4.5	.Bacterial biomass Lactobacillus, Spirulina	3	Discussion
5.1	Environmental Biotechnology : Biodegradation and Bioconservation. Biomass and Bioenergy: Petrocrops (Euphorbia, Hevea rubber, Algal hydrocarbons),	3	PPT
5.2	Gasification, pyrolysis.	3	Black Board
5.3	Biofuels: Photobiological hydrogen production.	3	Black Board
5.4	Biogas: Models of biogas plants, Mechanisms and techniques	6	PPT
5.6	Sewage and effluent treatment: Activated sludge treatment	3	PPT
	TOTAL	**90**	

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Department of Botany

(For those joined M. Sc., Botany on or after June 2019)

Programme Code-PBO

Course Code	Course Title	Category	L	T	P	Credit
PBO19CL41	**Plant Biotechnology Lab**	**Core Lab-7**		**-**	**6**	**4**

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

Preamble

To equip the students with the practical applications of plant biotechnology, industrial biotechnology and agricultural biotechnology

Course Outcomes

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

#	Course Outcome	Knowledge Level (according to Bloom's Taxonomy)
CO1	To produce and estimate alcohol from yeast fermented substrate	K1
CO2	To produce and estimate citric acid from Aspergillus fermented substrate	K2
CO3	Perform plant tissue culture experiments	K3
CO4	apply the knowledge of biotechnology in conversion of waste into vermicompost	K3, K4
CO5	Produce biofeftilizers	K2, K5

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

Mapping of COs with PSOs

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

S;Strong M:Medium L: Low

1. Fermentation by Yeast – Estimation of alcohol content.
2. Citric acid production by Aspergillusniger – Estimation of citric acid content.
3. Isolation of cellulolytic organisms by enrichment culture method.
4. Isolation of Amylase producing organisms
5. Measurement of yeast biomass production by turbidity method. .
5. Immobilization of microbes in calcium alginate beads.
6. Effect of biofertilizers on plant biomass.
7. Seed pelleting with Biofertilizers
8. Isolation of nitrogen fixing bacteria from soil.
9.Isolation ofand phosphate solubilizing bacteria from soil
10. Demonstration of Vermicomposting.
11. Induction of callus in *Daucas, Datura*and *Nicotiana*
12. Isolation of Protoplasts and protoplast fusion
13. Cell suspension culture

Thiagarajar College (Autonomous): Madurai – 625 009

Department of Botany

(For those joined M. Sc., Botany on or after June 2019)

Programme Code-PBO

Course Code	Course Title	Category	L	T	P	Credit
PBO19C42	Plant Ecology, Environment and Evolution	**Core - 8**	**6**	**-**	**-**	**5**

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

Preamble

To facilitate the students to realize the components, their progress, current status and solutions to environment related issues

Course Outcomes

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

#	Course Outcome	Knowledge Level
CO1	Reveal the facts related to environmental components	K1
CO2	Identify values of biodiversity and evolve conservation strategies	K2
CO3	Comprehend natural and anthropogenic risks related to environment	K2, K3
CO4	Perform analytical methods in environmental management	K3,K4
CO5	Adapt the concepts of sustainable environmental management through acquired knowledge and analytical skills	K3, K5

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

Mapping of COs with PSOs

	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	S	**L**	**M**	**M**
CO2	S	S	**L**	**M**	S
CO3	**M**	**L**	S	S	**M**
CO4	**M**	**L**	S	S	S
CO5	**L**	**M**	S	S	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	**60**	**60**	**150**

Unit I: Basic concepts in Ecology: Ecosystem Dynamics –Components explaining the functioning of ecosystem **-** biosphere–biotic interactions; Ammensalism, Commensalisms, Predation, Symbiosis, Parasitism –habitat and niche – ecosystem structure and function: Grassland, pond and estuarine – Mineral cycling: carbon, nitrogen and phosphorus; role in ecological stability and contribution to climate change – ecological succession: concept – categories - significance

Unit II: Population and Community Ecology: Characteristics of a population–population growthcurves – population regulation – life history strategies (r and k selection) – Communities; nature and structural attributes – methods of studying floristic communities – Quadrat and transect methods – Physiognomy classification of vegetation community – Phyto diversity indices: Jaccard's Similarity Co-efficient, Berger and Parker Index, Shannon's Diversity Index, Simpson's Dominance Index, and Margalef's Richness Index.

Unit III: Biodiversity and Conservation: Categories of biodiversity–species concepts: keystone,flagship, dominant and co-dominant – Biogeography: Major terrestrial biomes – theory of island biogeography – Biogeographical zones of India – Principles and approaches of conservation – *In-situ* conservation: National parks, Wildlife Sanctuaries, Biosphere reserves– *Ex-situ* conservation: Botanical and herbal gardens, zoological parks, seed orchards and gene banks.

Unit IV: **Environmental problems and Management:** Pollution: primary and secondarypollutants - Global warming and green-house effect, El-nino and La-nino, Ozone depletion, Habitat changes, GMO's, Invasive species, - Environmental impact assessment – Bio-remediation and phyto-remediation – Biosensors – Application of remote sensing and GIS in environmental management.

Unit V: Evolution: Evolutionary time-scale (Major events)–concept of Oparin and Haldane– experiment of Miller (1953) – origin of eukaryotic cells and aerobic metabolism – gene pool, gene frequency, Hardy-Weinberg Law - rate of change in gene frequency through natural selection, migration and random genetic drift - founder effect - convergent evolution and divergent evolution: allopatric, peripatric, parapatric and sympatric speciation – adaptive radiation - co-evolution – altruism – group and kin selection .

Text Books:

1. Subramanyam, N.S. and A.V.S.S. Sambamurthy. 2000. Ecology, Narosa Publishing House, New Delhi.
2. Chiras, D.D. 2012. Environmental Science, 9th edition, Jones and Bartlett India Pvt.Ltd., New Delhi.
3. Verma, P.S. and V.K. Agarwal. 2006. Cell Biology, Genetics, Molecular Biology, Evolution and Ecology, S.Chand& Company Ltd., New Delhi.
4. Krishnamurthy, K.V. 2004. Text Book of Biodiversity, Oxford and IBH Publishing Company Pvt. Ltd, New Delhi.
5. Dobzhansky, T., F.J. Ayala, G.L.Stebbins and J.W. Valentine. 1973. Evolution, Surjeet Publications, Delhi.
6. Bhatta, B. 2009. Remote Sensing and GIS, Oxford University Press, New Delhi.

Reference Books:

1. Peter Stiling, 2002. Ecology, Theories and Applications, Prentice-Hall of India, New Delhi.
2. Jeffries, M.J. and M.J. Jeffries. 2005. Biodiversity and Conservation, Routledge Taylor & Francis Group, UK.
3. Saha, T.K. 2011. Ecology and Environmental Biology, Books and Allied (P) Ltd, Delhi.
4. Townsend, C.R., M. Begon and J.L.Harper, 2000. Essentials of Ecology, Blackwell Publishing Company, USA.
5. Russell, P.J., S.L.Wolfe, P.E. Hertz, C.Starr and Mcmillan.2008. Ecology, Cengage Learning India Pvt. Ltd, New Delhi.

Course Designers:

1. Dr. D. Kannan

2. Dr. K. Saraswathi

Lecture Schedule

Unit	Topic	Lecture hrs.	Method
1.1	Ecosystem components	3	Black Board
1.2	Ecosystem interactions	3	PPT
1.3	Ecosystem structure	4	PPT
1.4	Ecosystem functions	4	PPT
1.5	Ecological Succession	4	PPT
2.1	Population characters	4	Black Board
2.2	Population life history	4	Black Board
2.3	Community attributes	4	Black Board
2.4	Community analysis methods	3	PPT
2.5	Diversity indices	3	Black Board and Practical demonstration
3.1	Categories of biodiversity	4	Black Board
3.2	Species Concept	4	Black Board
3.3	Biogeography	3	PPT
3.4	In-situ conservation	3	PPT
3.5	Ex-situ conservation	3	PPT
4.1	Pollution	4	PPT
4.2	Global Warming and Green house Effect	4	Discussion
4.3	El-nino and La-nino	2	Discussion
4.4	Ozone depletion	2	Discussion
4.5	GMos	2	Discussion
4.6	Invasive species	1	Black Board
4.7	Bioremediation	1	Black Board
4.8	Biosensors	1	PPT
4.9	GIS	1	PPT
5.1	Evolutionary Time Scale	3	PPT
5.2	Evolution of Eukaryotic cell	3	Black Board
5.3	Hardy- Weignberg law	3	Black Board
5.4	Founders Effect and Co-evolution	3	PPT
5.5	Convergent and Divergent Evolution	3	PPT
5.6	Speciation	3	PPT
TOTAL		**90**	

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Department of Botany

(For those joined M. Sc., Botany on or after June 2019)

Programme Code-PBO

Course Code	Course Title	Category	L	T	P	Credit
PBO19CL42	Plant Ecology, Environment and Evolution	**Core Lab- 8**	**-**	**-**	**6**	**4**

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

Preamble

To facilitate the students to realize the components, their progress, current status and solutions to environment related issues

Course Outcomes

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

#	Course Outcome	Knowledge Level (according to Bloom's Taxonomy)
CO1	Estimate the nutrients in water	K1
CO2	Analyze the soil nutrients	K2
CO3	Construct quadrats	K2, K3
CO4	Estimate the primary productivity of an ecosystem	K3,K4
CO5	Construct survivorship curve	K3, K5

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

Mapping of COs with PSOs

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

S;Strong M:Medium L: Low

1. Water analysis: Salinity, Alkalinity, BOD, COD, DO and free CO_2.
2. Soil analysis: Soil moisture, Soil pH, Organic Carbon, Nitrogen, Phosphate-Phosphorus ,
3. Vegetation analysis using Quadrat and Transect (Line & Belt) method. Calculation of Frequency, Abundance and Density
4. Classification of plant life-forms using Raunkaier‘s frequency class distribution.
5. Determination of Biodiversity indices: Shannon’s – Weiner index, Simpson’s index, Jaccard’s Similarity co-efficient and Margleaf’s Species Richness index
6. Construction of Survivorship curve using available data
7. Estimation of Primary productivity in a constructed Pond
8. Demonstration of Natural Selection.
9. Demonstration of Genetic Drift.
10. Submission: a) Record Note, b) Field note book and c) Environmental Diary

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Programme Code PBO

Course Code	Course Title	Category	L	T	P	Credit
PBO19CE41	**Project**	Core Elective-4	-	-	6	6

Year	Semester	Int. Marks	Ext.Marks	Total
Second	Fourth	40	40+20	100

Preamble

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

Prerequsites

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

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

K1: Remember K2: Understand K3: Apply K4: Analyze K5: Evaluate

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

S;Strong M:Medium L: Low

M.Sc. Botany

Assessment values of course learning outcomes and their mapping with program specific outcomes (PSOs)

Major papers

Course	Title of the courses	PSO1	PSO2	PSO3	PSO4	PSO5
Core 1	Thallophytes, Bryophytes, Pteridophytes and Gymnosperms	10	13	8	11	8
Core 2	Plant Cell and Molecular Biology	9	11	10	11	10
Elective 1	Developmental Botany	9	11	10	11	10
Core Lab 1	Thallophytes, Bryophytes, Pteridophytes and Gymnosperms Lab	11	14	9	11	9
Core Lab 2	Plant Cell and Molecular Biology Lab	11	11	13	11	1
Core 3	Plant Biochemistry and Biotechniques	9	11	10	11	10
Core 4	Microbiology and Plant Pathology	11	12	11	9	8
Elective2	Computer Applications in Biology and Biostatistics	12	11	12	14	11
Core Lab 3	Plant Biochemistry and Biotechniques Lab	9	11	9	11	10
Core Lab 4	Microbiology and Plant Pathology Lab	11	12	11	9	8
Core 5	Angiosperm Taxonomy	11	10	12	9	11
Core 6	Plant Physiology	9	15	8	5	9
Elective3 IDC	Interdisciplinary paper: Applied Zoology	9	15	10	11	10
Core Lab 5	Angiosperm Taxonomy lab	12	12	12	9	13
Core Lab 6	Plant Physiology lab	9	15	10	11	10
Core 7	Plant Biotechnology	9	15	8	5	9
Core 8	Plant Ecology, Environment and Evolution	11	10	11	11	13
Core Lab 7	Plant Biotechnology lab	11	15	8	12	9
Core Lab 8	Plant Ecology, Environment and Evolution lab	11	11	11	13	13
Project	Project	14	12	13	10	10

M.Phil. Botany

Programme Code : MBO

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

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

M.Phil. 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

PEO1	Graduates of the program will develop competent knowledge in Plant science required for continuous learning and research.
PEO2	Graduates will develop diversified basic professional skills through various laboratory technical training, communication and presentation skills.
PEO3	Graduate will possess an ability to identify, formulate, and solve Plant problems to contribute to service efforts to community in both the professional and private realm
PEO4	Gradates will integrate related topics from separate parts of the course such as Research Methodology, Conservation biology and Signalling molecules for successful career.
PEO5	Graduates will be proficient to assess the scope of plant sciencein research

Programme specific outcomes- M.Phil.,Botany

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

PO1	formulate a research plan on various plant life forms,
PO2	Develop conservation strategies for endangered plant species
PO3	demonstrate the skill of wrting research papers
PO4	exhibit proficiency in the areas of biostatistics and computer applications in modern topics of Life Sciences
PO5	exhibit proficient laboratory skills and in contemporary and advance techniques related to Life Science

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Programme Code MBO

MASTER OF PHILOSOPHY IN BOTANY

Programme scheme and scheme of valuation

I semester

Course	Code	Subject/Paper	Cont Hrs/w	Total Hrs	Max Mark CA	Max Mark SE	Total
Core 1	MBO19C11	Research Methodology	6	90	100	100	200
Core 2	MBO19C12	Frontiers in Conservation Biology	6	90	100	100	200
Core 3	MBO19C13	Biomolecules and Signal Transduction in Plants	6	90	100	100	200

II semester

Course	Code	Subject/Paper	Cont Hrs/w	Total Hrs	Max Mark CA	Max Mark SE	Total
Project	MBO19D&VV	Dissertation*			--	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.

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Programme Code MBO

Course Code	Course Title	Category	L	T	P	Credit
MBO19C11	Research Methodology	**Core - 1**	**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 (according to Bloom's Taxonomy)
CO1	undertake research through peer guidance	K1
CO2	apply Biotechniques in the classical and advanced research fields of Plant Biology	K2, K4
CO3	apply the statistical concepts to solve the research methodology	K2, K6
CO4	prepare scientific reports, dissertation, oral and poster presentation	K3,K6
CO5	have awareness on plagiarism and get to know for the self-preparation	K3,K5

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

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	**II Internal**	
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
TOTAL	**120**	**120**	**200**

Unit 1: Microscopy: Structure, working principle and applications of Fluorescencemicroscope, 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: Chromatography: Principles and applications of chromatography HPLC and Gaschromatography. Electrophoresis: Agarose gel electrophoresis, Polyacrylamide gel electrophoresis, PCR Technique, X-Ray crystallography, EPR, ESR analysis. Radiography: measuring radiography – Scintillation counters – Geiger Muller – Autoradiography – Application of radioactivity.

Unit 3: Research design–Basic Principles- Need of research design—Features of gooddesign – 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

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 tersts Simple and linear regression- and correleation- Principle statistical method and interpretation Theoretical Distribution – Normal, Binomial and Poission; 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

References:

Pyrczak, F. and Bruce, R. 2017 (8th Edition), Routlage Publishers, USA.

Rosner, B. 2010. (11th Edition) Fundamentals of Biostatistics, Brooks and Cole Publishers, UK.

Jayaraman.J.1981. *Laboratory Manual in Biochemistry*.Whiley Eastern Limited, New Delhi.

Einspruch, E.L. 2005. (2nd 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). *Biointrumentation.* John Wiley & sons (Asia) Pvt.. Ltd., Singapore.

Whtney, 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

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Programme Code MBO

Course Code	Course Title	Category	L	T	P	Credit
MBO19C12	**Frontiers in Conservation Biology**	**Core - 2**	**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 (according to Bloom's Taxonomy)
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 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

Blooms Taxonomy			
	CA		**End of Semester Marks**
	I Internal	**II Internal**	
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
TOTAL	20	20	40

Unit 1: Biodiversity- introduction- current state of biological diversity-Global patterns ofspecies richness-Abiotic and biotic theory for species richness gradients-Rain forest as centers of diversity – Ecological diversity in coastal zones and oceans. Measures of Biodiversity: Alpha. Beta and gamma diversity. Diversity indicies: Dominance and evenness. Diversity crises in the geological past.

Unit 2: Values of biodiversity-ecosystem services- screening plants for medicines- Newagricultural 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: The effect of global climatic change on natural communities- IUCN categories ofextinction-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- Bodiversity act 2002.

Unit 4: Remote sensing : Introduction-Analysis techniques-Digital image processing-Role ofremote sensing in biodiversity management-GIS and biodiversity, landscape elements, Oceans colour and fishery, water security. Environment assessment and monitoring.

Unit 5: Conservation :*In situ*and*Ex situ*conservation methods- conservation of biologicaldiversity in Botaniocal 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. Principals 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, Saund

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Programme Code MBO

Course Code	Course Title	Category	L	T	P	Credit
MBO19C13	Biomolecules and signal transduction in Plants	**Core - 3**	**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 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

Blooms Taxonomy			
	CA		**End of Semester Marks**
	I Internal	**II Internal**	
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
TOTAL	**120**	**120**	**200**

Unit I: Biomolecules and biomacromolecules (brief account)–- secondary metabolites andtheir 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: Cell Signaling molecules: Bioactive molecules in cell signaling–G-proteins,Phosphoinositides, ITP, MAP and CD Kinases – Secondary messengers- Calcium and calmodulin protein. 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 – regulation of signaling pathways.
Unit III: Principles of Cell Communication: Abiotic influence on organisms–trans-organismic communication – intra- organismic communication – cell adhesion and roles of different adhesion molecules – gap junctions – extra-cellular matrix – integrins – bacterial , plant two component systems – bacterial chemotaxis and quorum sensing.
Unit IV: Light signaling in plants: photobodies, photoreceptors-types, photosyntheticpigments, 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 entryprocesses 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, 4th Edition, Benjamin/ Cummings Publishing Company, California.

Kendrick, R.E. and Kronenberg, G.H.M.1994. Photomorphogenesis in plants, 2nd 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.

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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://ebookee.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 2019)

Programme Code MBO

Course Code	**Course Title**	**Category**	**L**	**T**	**P**	**Credit**
MBO19D&VV	Project work and viva voce			-	-	

Semester	**Int. Marks**	**Ext.Marks**	**Total**
Second	50	150	200

Preamble

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

Prerequsites

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

	Course outcomes	Level
CO1	Collect and analyse the scientific literature from web resources	K1,K2
CO2	Explain the theoretical basis of the tools, technologies and methods common to microbiology;	K2,K5
CO3	Demonstrate practical skills in the use of tools, technologies and methods common to microbiology,	K3,K4
CO4	Apply the scientific method and hypothesis testing in the design and execution of experiments.	K3,K6
CO5	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

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

S;Strong M:Medium L: Low

M.Phil. Botany

Assessment values of course learning outcomes and their mapping with program specific outcomes (PSOs)

Major papers

#	Title of the courses	PSO1	PSO2	PSO3	PSO4	PSO5
Core 1	Research Methodology	10	13	8	11	8
Core 2	Frontiers inConservation Biology	10	13	12	13	8
Core 3	Biomolecules and SignalTransduction in Plants	10	13	12	11	10
Project	Dissertation and Viva voce	13	13	10	11	10

B.Sc., Biotechnology

Programme Code-UBT

THIAGARAJAR COLLEGE, MADURAI – 9.

(Re-Accredited with 'A' Grade by NAAC)

Curriculum structure for

B.Sc., CS, IT & BCA BBA & B.Com

(For those who joined in 2019 and after)

Catergory	Course	No.of Courses /paper	Credit Distribution	Hrs/ Week	Total Credits
Part I	Tamil	2	3	-	06
Part II	English	2	3	-	06
		Sub Total			**12**
Part III	Core	-	-	-	84
	Elective –Main	2	5	-	10
	Elective – Generic	2+2	5	-	20
		Sub Total			**114**
Part IV	**AECC** I &II Sem	I sem EVS II Sem .Prof.Skill Development	2	4	04
	NME III & V Sem Horizontal Migration **SEC** IV & VI Sem Vertical Migration	2 2	2	8	08
	Value Education V Sem	1	1	2	**01**
		Sub Total		**14**	**13**
	Total				**139**
Part V	**NCC (Army &Navy)/ PE/ NSS / Rotaract/ Quality Circle/ Library/ SSL/ Nature Club/Value Education/ YRC/WSC**				**01**
	Grand Total				**140**
	Self-Study Paper (Optional)- -V Sem			**05**	**145**

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 &V semester)
- For SEC every department offer three papers for each course (Sem IV & VI)
- For Major elective there may be an option for choice.

THIAGARAJAR COLLEGE, MADURAI – 9.

(Re-Accredited with 'A' Grade by NAAC)

Curriculum structure for

BA Tamil, English & Economics

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

(For those who joined in 2019 and after)

Catergory	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
		Sub Total		**48**	**24**
Part III	Core			72 +12	72
	Elect –Main	2	5	10	10
	Elect – Generic	2+2	5	24	20
		Sub Total		**118**	**102**
Part IV	**AECC** I &II Sem	I sem EVS II Sem .Prof.Skill Development	2	4	04
	NME III & V Sem Horizontal Migration **SEC** IV & VI Sem Vertical Migration	2 2	2	8	08
	Value Education V Sem	1	1	2	**1**
		Sub Total		**14**	**13**
	Total				**139**
Part V	**NCC (Army &Navy)/ PE/ NSS / Rotaract/ Quality/WSC Circle/ Library/ SSL/ Nature Club/Value Education/ YRC**				**1**
	Grand Total				**140**
	Self-Study Paper (Optional)- -V Sem			**05**	**145**

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 &V semester)
- For SEC every department offer three papers for each course (Sem IV & VI)
- For Major elective there may be an option for choice.

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

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.

Programme Educational Objectives (PEO)

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

PEO1	Graduates of this program will build up competency in basic Biotechnology required for decisive learning and research.
PEO2	Graduates will develop diversified indispensable professional skills through a wide range of laboratory technical training, communication and presentation skills.
PEO3	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.
PEO4	Gradates 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.
PEO5	Graduates could develop adequate skill to evaluate the scope of biotechnology, understand the complexities of microbes, plants and animal system and addresscontentious scientific issues in a lucid way.

Programme specific outcomes- B.Sc.,Biotechnology

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

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

THIAGARAJAR COLLEGE ,MADURAI-9.
(Re-Accredited With A Grade by NAAC)
Department of Botany
B.Sc. Biotechnology Curriculum **(w.e.f. 2019 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	U19TM11	Tamil	6	3	90	25	75	100
Part II	U19EN12	English	6	3	90	25	75	100
Core I	UBT19 C11	General Microbiology	6	6	90	25	75	100
Core Lab 1	UBT19 CL11	General Microbiology lab	4	2	60	40	60	100
Generic Elective	UBT19 GE11	Analytical Biochemistry	4	4	60	25	75	100
Generic Elective lab1	UBT19 GL21	Analytical Biochemistry Lab	2	-	30			
AECC	U19ES11	Environmental Studies	2	2	30	15	35	50
Total			30	20				550

Semester -II

Course	Code No.	Subject	Hrs/ week	Credits	Total Hrs	Max Mark CA	Max Mark SE	Total
Part 1	U19TM21	Tamil	6	3	90	25	75	100
Part II	U19EN22	English	6	3	90	25	75	100
Core 2	UBT19 C21	Cell Biology	6	6	90	25	75	100
Core Lab 2	UBT19 CL21	Cell Biology Practical	4	2	30	40	60	100
Generic Elective	UBT19 GE21	Biomolecules	4	4	60	25	75	100
Generic Elective lab2	UBT19 GL21	Analytical Biochemistry &Biomolecules lab	2	2	30	40	60	100
AECC2	UBT19AE 21	Personality Development	2	2	30	15	35	50
Total			30	22				650

Semester-III

Course	Code No.	Subject	Hrs/ Week	Credits	Total Hrs	Max mark CA	Max Mark SE	Total
Part 1	U19TM31	Tamil	6	3	90	25	75	100
Part 2	U19EN32	English	6	3	90	25	75	100
Core 3	UBT19C31	Molecular Biology	4	4	45	25	75	100
Core 4	UBT19C32	Basics of Computers and Bioinformatics	4	4	60	25	75	100
Core lab3	UBT19CL31	Molecular biology & Basics of Computers and Bioinformatics lab	2	1	60	40	60	100
Generic Elective3	UBT19GE31	Genetics &Biostatistics	4	4	60	40	60	100
Generic Elective lab 3	UBT19GL41	Genetics & Biostatistics lab	2	-	30	-	-	-
NME1	UBT19NE31	Food processing 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	U19TM41	Tamil	6	3	90	25	75	100
Part 2	U19EN42	English	6	3	90	25	75	100
Core 5	UBT19 C41	Immunology	4	4	45	25	75	100
Core6	UBT19 C42	Clinical Laboratory Technology	4	4	45	25	75	100
Core lab 4	UBT19 CL42	Immunology& Clinical laboratory technology lab	2	1	60	40	60	100
Generic Elective 4	UBT19 GE41	Physiology	4	4	60	25	75	100
Generic Elective lab 3&4	UBT19GL41	Genetics and Biostatistics & Physiology lab	2	2	30	40	60	100
SCE1	UBT19 SE41 A/B/C	SEC(A) Mushroom Technology ; SEC(B) Organic farming; SEC(C) & Plant Tissue Culture	2	2	30	15	35	50
Total			30	23				750

Semester-V

Course	Code No	Subject	Hrs/ Week	Credits	Total Hrs	Max marks CA	Max marks SE	Total
Core 7	UBT19 C51	Genetic Engineering	5	5	60	25	75	100
Core 8	UBT19 C52	Industrial Biotechnology	4	4	60	25	75	100
Core 9	UBT19 C53	Marine Biotechnology	4	4	45	25	75	100
Core lab 5	UBT19 CL51	Genetic Engineering lab	3	2	60	40	60	100
Core lab 6	UBT19 CL52	Industrial Biotechnology lab	4	2	60	40	60	100
Core lab 7	UBT19 CL53	Marine Biotechnology lab	2	1	30	40	60	100
Core Elective1	UBT19 CE51 A/B/C	(A) Applied Microbiology (B) Metabolic path ways (C) Infectious diseases	4	5	75	25	75	100
NME2	UBT19 NE51	Vocational Biotechnology	2	2	30	15	35	50
VE		Value education	2	1	30	15	35	50
Total			30	26				800

Semester -VI

Course	Code No.	Subject	Hrs/ Week	Credits	Total Hrs	Max marks CA	Max SE marks	Total
Core10	UBT19C61	Plant Biotechnology	5	5	75	25	75	100
Core11	UBT19C62	Animal Biotechnology	5	5	75	25	75	100
Core12	UBT19C63	Environmental Biotechnology	4	4	60	25	75	100
Core lab 8	UBT19CL6 1	Plant Biotechnology Practical	3	2	45	40	60	100
Core lab 9	UBT19C62	Animal Biotechnology	3	2	45	40	60	100
Core lab 10	UBT19C63	Environmental Biotechnology lab	4	2	60	40	60	100
Core Elective 2	UBT19 CE61	(D)Genomics (E)Food Biotechnology (F)Biosafety&IPR (G)Biodiversity & conservation	4	5	60	25	75	100
SEC2	UBT19 SE61 D/E/F	(D)Herbal medicine (E) Health & Hygiene (F)Microscopy & Microtechniques	2	2	30	15	35	50
Part V			-	1				
Total			30	28				750

Total Credits for Semesters 1-6 ---140 (20+22+21+23+26+28)

A) CONSOLIDATION OF CONTACT HOURS AND CREDITS: UG

Semester	Contact Hrs/ Week	Credits
I	30 hrs.	20
II	30 hrs.	22
III	30 hrs.	21
IV	30 hrs.	23
V	30 hrs.	26
VI	30 hrs.	28
Total	180 hrs	140

B) Curriculum Credits: Part wise

Part I	**Tamil**	**4x3 = 12 Credits**
Part II	**English**	**4x3 = 12 Credits**
Part III	**Core**	**= 72 Credits (8+8+10+10+17+19)**
	Generic Electives	**= 20 Credits (4+4+2) +(4+4+2)**
	Core Electives (2)	**= 10 Credits**
AECC1	**Environmental studies**	**1x2 = 02 Credits**
AECC2	**Presentation skills**	**1x2 = 02 Credits**
	Skill Based Electives	**2x2 = 04 Credits**
	Non – Major Electives	**2x2 = 04 Credits**
	Value Education	**1x1= 01 Credit**
	Total	**139 Credits**
Part V		**1 Credit**
		140 Credits

Thiagarajar College (Autonomous): Madurai – 625 009
Department of Botany
(For those joined B.Sc. Biotechnology on or after June 2019)
Programme Code- UBT

Course Code	Course Title	Category	L	T	P	Credit
UBT19C11	General Microbiology	Core-1	6	-	-	6

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

Preamble

Acquire an exposure to the classification of microorganisms, diversity of microbial structure and their role

Course Outcomes

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

#	Course Outcome	Knowledge Level (according to Bloom's Taxonomy)
CO1	Acquire knowledge on the differences between prokaryotes &eukaryotes, appreciate the contribution of scientists.	K1
CO2	Understand 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.	K3

K1 - Knowledge K2 - Understand K3 - Apply

Mapping of COs with POs

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

S-Strong M- Medium L-Low

Blooms taxonomy

	CA		End of Semester
	First	**Second**	
Knowledge	**40%**	**40%**	**40%**
Understand	**40%**	**40%**	**40%**
Apply	**20%**	**20%**	**20%**
Total Marks	**52**	**52**	**140**

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 Leewenhock, Pasteur, Koch, 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 (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 - diauxy 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 and Prions.

Text Books:

- Sharma, P.D. 2004. Microbiology, Second edition. Rastogi publication, Meerut.
- Daniel Lim. 1998. Microbiology, Second edition. McGraw Hill publications, New York.

- Pelczar, M. J. Jr., E. C. S. Chan. and N. R. Krieg. 2001. Microbiology, 5th edition. Tata Mc Graw Hill publication, New Delhi. 900pp.
- Stanier, R. Y. and J. L. Ingraham. 1987. General microbiology, 5th edition, Macmillan press Ltd. London.

Reference Books:

- Prescott, L.M., J. P. Harley and D. A. Klein. 2003. Microbiology 6th Edition. McGraw Hill, New York.
- Atlas, R. M. 1998. Principles of Microbiology, Second edition. Mosby yearbook publication, Missori.

Course designers:

1. **S.Yogachitra**
2. **S.Siva Durga**

Course contents and lecture schedule

Unit	**Topic**	**No of lecture hrs.**	**Method of teaching**
1.1	Introduction to microbes: Prokaryotes - Algae, fungi, protozoa, and mycoplasma	3	Black board
1.2	Differences between prokaryotes and eukaryotes	3	Power point
1.3	Important milestones in microbiology: spontaneous generation theory- contributions of Leewenhock, Pasteur, Koch, Paul Ehrlich, Joseph Lister, Tyndall, Jenner, Winogradsky, Beijerinck, Beadle and Tatum, Avery.	6	Power point
2.1	Classification of Bacteria: Characters used in classification.	5	Black board
2.2	Approaches to Classification-Natural approach, Phylogenetic approach, Numerical approach and Molecular approach.	5	Black board
2.3	Outline of bacterial classification as per Bergey‘s manual of determinative bacteriology, eighth edition.	5	Black board
3.1	Morphology and fine structure of bacteria: Structures outer to cell wall, capsule, slime, flagella and pili;	5	Black board
3.2	structures inner to the cell wall - plasma membrane, cytoplasmic matrix, Cytoplasmic inclusions (PHB), glycogen, ribosomes, brief account on chromosomes, plasmids and endospore	5	Black board
3.3	cell wall-peptidoglycan structure.	5	Black

			board
3.4	Culture media: complex & defined media, differential and enriched media	5	Black board
3.5	sterilization methods-pure culture techniques.	5	Black board
4.1	Microbial Nutrition: Macro and Micro Nutrients –	5	Black board
4.2	– Nutritional types of bacteria	5	Black board
4.3	uptake of nutrients: simple diffusion, facilitated diffusion, ABC transporter and group translocation.	10	Power point
4.4	Microbial growth: sigmoid growth - diauxy growth-generation time- measurement of microbial growth – continuous growth – synchronous growth - factors affecting growth.	6	Black board
5.1	Structure and multiplication of viruses:	5	Black board
5.2	Classification of Viruses. Plant virus (TMV), Bacteriophage (T4), Animal virus (Pox), Viroids and Prions.	10	Power point
	Total hours	75	

Thiagarajar College : Madurai – 625 009
Department of Botany
(For those joined B.Sc. Biotechnology on or after June 2019)
Programme Code: UBT

Course Code	Course Title	Category	L	T	P	Credit
UBT19CL11	General Microbiology Lab	**Core Lab 1**	**-**	**-**	**4**	**2**

Year	Semester	Internal Marks	External Marks	Total Marks
I	I	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 (according to Bloom's Taxonomy)
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

K1 - Knowledge K2 - Understand K3 - Apply

Mapping of COs with POs

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

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. Measurement 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.

Course contents and lecture schedule

S.No.	Experiment	No of hrs.	Method of teaching
1	Preparation of culture media	2	Hands on Training.
2	Isolation of microbes from soil and drinking water.	5	Hands on Training.
3	Pure culture techniques: Pour, Spread, Streak plate method, mycelia agar plug method.	12	Hands on Training
4	Micrometry	2	Hands on Training.
5	Observation of motility of Bacteria – Hanging drop method	2	Hands on Training.
6	Bacterial Staining methods: a) Simple b) Negative c) Acid fast d) Gram‘s e) spore f) Capsule Staining.	16	Hands on Training.
7	Fungal staining with lactophenol cotton blue.	2	Hands on Training.
8	Measurement of microbial count: a) Bacteria-viable count method and b) haemocytometer method.	4	Hands on Training.
9	Growth curve.	3	Hands on Training.
10	Carbohydrate fermentation	2	Demonstration
11	IMVIC test	2	Demonstration
12	Starch hydrolysis	2	Demonstration
13	Catalase activity	2	Demonstration
14	Oxidase activity	2	Demonstration
15	Cellulose hydrolysis.	2	Demonstration
Total Hours		60	

TEXT BOOKS:

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

REFERENCE BOOKS:

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

Thiagarajar College (Autonomous): Madurai – 625 009
Department of Botany
(For those joined B.Sc. Biotechnology on or after June 2019)
Programme Code: UBT

Course Code	Course Title	Category	L	T	P	Credit
UBT19GE11	Analytical biochemistry	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	Elucidate 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
CO1	**S**	**L**	**L**	**S**	**L**
CO2	**L**	**S**	**L**	**M**	**L**
CO3	**L**	**L**	**M**	**L**	**L**
CO4	**L**	**L**	**L**	**M**	**L**
CO5	**L**	**M**	**S**	**L**	**S**

S-Strong M- Medium L-Low

Blooms taxonomy

	CA		End of Semester
	First	**Second**	
Knowledge	**40%**	**40%**	**40%**
Understand	**40%**	**40%**	**40%**
Apply	**20%**	**20%**	**20%**
Total Marks	**52**	**52**	**140**

Title of the paper: Analytical biochemistry

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.

ReferenceBooks:

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

Course Designer: G. Ramya vaideki

Course contents and lecture schedule

Unit	Topic	Llecture hrs.	Teaching Method
1.1	Microscopy: Principles, instrumentation and applications of simple, compound and electron microscopes.	2	Powerpoint
1.2	pH metry: Principles, Operation method and uses. Buffer solutions for biological investigations.	4	Black board
1.3	Colorimetry: principles, instrumentation and applications. Spectroscopic techniques: General principles-UV-visible	4	Powerpoint
1.4	spectrophotometer- principles, instrumentation and applications	5	Powerpoint
2.1	Chromatography: Principles and applications of paper chromatography,	2	Black board
2.2	thin layer chromatography, adsorption chromatography, ion exchange chromatography, molecular sieve chromatography, affinity chromatography,	4	Powerpoint
2.3	gas chromatography and high performance liquid chromatography (HPLC).—	2	Powerpoint
3.1	Centrifugation techniques: Basic principles and sedimentation coefficient,	4	Black board
3.2	Types of centrifuges and centrifugation: different types: differential centrifugation, density gradient centrifugation applications of centrifuge.	4	Powerpoint
4.1	Radio isotope techniques: The nature of radioactivity	3	Black board
4.2	Detection and measurement of radioactivity –- Liquid Scintillation counting – Geiger-Muller counting of radioactivity	4	Powerpoint
4.3	Autoradiography Applications of radioisotopes in Biological sciences	5	Black board
5.1	Extraction of DNA, RNA and Protein – principle – method. Purification of DNA, RNA and Protein – principle – method.	5	Black board
5.2	. Electrophoresis: Principles–Types Paper electrophoresis, Polyacrylamide gel electrophoresis (PAGE)	4	Powerpoint
5.3	Agarose Gel Electrophoresis (AGE ,Capillary electrophoresis (CE).	4	Powerpoint
5.4	Applications of electrophoresis.	4	Black board
		Total hours	**60**

Thiagarajar College (Autonomous): Madurai – 625 009
Department of Botany
(For those joined B.Sc. Biotechnology on or after June 2019)
Programme Code : UBT

Course Code	Course Title	Category	L	T	P	Credit
UBT19GEL21	Analytical Biochemistry &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 (according to Bloom's Taxonomy)
CO1	Separate components using paper chromatography, column chromatography and TLC	K1
CO2	Isolate and quantify proteins	K2
CO3	Demonstrate Agarose gel electrophoresis and PAGE	K2
CO4	Demonstrate dialysis	K3

K1-Knowledge K2-Understand K3-Apply

Mapping of COs with POs

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

S-Strong M- Medium L-Low

1. Determination of pH in various samples
2. Buffer preparation (verification of Handerson - Hasselbalch equation)
3. Separation of amino acids by paper chromatography
4. Separation of leaf pigments by Column chromatography
5. Separation of sugars by TLC
6. Isolation and quantification of proteins(Lowry method)

7. Demonstration of SDS PAGE
8. Demonstration of Agarose gel electrophoresis
9. Electrophoresis of RNA
10. Demonstration of dialysis

Course Designer:
G. Ramya Vaideki

Course contents and practical schedule

Exp. No.	**Name of the Experiment**	**Practical hours**	**Method**
1.	Determination of pH in various samples	2	Hands on training
2.	Buffer preparation (verification of Handerson - Hasselbalch equation)	2+2	Hands on training
3.	Separation of amino acids by paper chromatography	2	Hands on training
4.	Separation of leaf pigments by Column chromatography	2	Hands on training
5.	Separation of sugars by TLC	2	Hands on training
6.	Isolation and quantification of proteins(Lowry method)	2+2	Hands on training
7.	Demonstration of SDS PAGE	2+2	Demonstration
8.	Demonstration of Agarose gel electrophoresis	2+2	Demonstration
9.	Electrophoresis of RNA	2	
10.	Demonstration of dialysis	2+2	Hands on training
Total hours:30			

Thiagarajar College : Madurai – 625 009
Department of Botany
(For those joined B.Sc. Biotechnology on or after June 2019)
Programme Code: UBT

CourseCode	Course Title	Category	L	T	P	Credit
UBT19C21	**Cell Biology**	**Core-2**	**6**	**-**	**-**	**6**

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

Preamble

To provide the students with the basic 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	Elucidate the structural organization of prokaryotic and eukaryotic cells.	K1
CO2	Illustrate different levels of organization, chemical composition and functional significance of cell organelles.	K2
CO3	Analyze the functions of nucleus and mitotic cell division and its significance in growth and development.	K2
CO4	Illustrate the stages of meiosis and its impact on reproduction.	K3
CO5	Evaluate the structural and numerical changes in chromosomes, causes and effects of gene mutations.	K3

K1 - Knowledge K2 - Understand K3 – Apply

Mapping of COs with POs

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

S-Strong M- Medium Low-Low

Blooms Taxonomy

	CA		End of Semester
	First	Second	
Knowledge	**40%**	**40%**	**40%**
Understand	**40%**	**40%**	**40%**
Apply	**20%**	**20%**	**20%**
Total Marks	**52**	**52**	**140**

Title of the paper: Cell Biology

Unit I: Cell as a basic unit of function – cell theory. Ultra structure and functions of plant cell and animal cell. Cell wall: Ultrastructure, chemical nature, origin and functions. Bio-Membrane: structure -fluid mosaic model.

Unit II: Organelles: Ultra-structure and chemical composition of Mitochondria. Ultra-structure and chemical composition of Chloroplast, endoplasmic reticulum, microsomes, golgi complex lysosomes and ribosomes. Non-living inclusions or ergastic substances. Nucleus: Morphology and ultrastructure. Chromosomes: morphology of eukaryotic chromosomes, heterochromatin, euchromatin.

Unit III: Nucleus, Nucleolus, Chromosomes, Nucleosome, Salivary gland and lamp brush chromosomes. The Cell cycle: Mitosis and meiosis.: S-Phase, G1-phase, interphase, prophase, metaphase, anaphase, telophase, mitogen, microtubules, tubulins, centromere, kinetochore and cytokinesis.

Unit IV: The reproductive cycle- Stages of meiosis, significance of meiosis: - Chromomere, synapsis, synaptonemal complex, synaptomeres, lateral element, central element, transverse elements, chiasma and recombination.

Unit V: Numerical changes in chromosomes – Aneuploidy and Euploidy:- Monosomy, nullisomy, trisomy, tetrasomy, Down's syndrome, autopolyploid, haploid, colchicines. Gene mutations, oncogenes, oncoproteins and cancers.

<u>Text books</u>:

- Gerald Karp. 2002 Cell and Molecular Biology, John Wiley & Sons, New York
- Geoffery. H. Cooper et al., 2004. Cell – Molecular approach, ASM press, Washington.
- Gupta, P.K. 2004. Cell and Molecular Biology. Third Edition. Rastogi Publications.
- Sharma, A.K and Sharma, A. 1999. Plant Chromosomes: Analysis, Manipulation and Engineering, Harwood Academic Publications, Australia.
- Verma, P.S and Agarwal, V.K. 1993. A Textbook of cytology. S. Chand & Co, New Delhi.
- Dnyansagar, V.R. 1987. Cell and Molecular Biology. Holt Saunders International, New York, USA. 7. Krishnamurthy, K.V. 1988. Methods in Plant Histochemistry. Viswanathan (Printers & Publishers) PVT Ltd, Chennai.
- Becker, W.M., Kleinsmith, L.J. and Hardin, J. 2007. The World of the cell, sixth edition, Pearson Education, Inc.

Reference Books:

- DeRobertis, E.D.P. and DeRobertis, E.M.F. 2006. Essentials of Cell and Molecular Biology, Saunders College Publishing, Japan.
- Salisbury, F.B. and C. N. Ross. 2004. Plant Physiology. CBS publishers and Distributors. New Delhi.

Course designed by:
Dr. K. Thangavel

Course contents and lecture schedule

Unit	Topic	Lecture hrs.	Teaching Method
1.1	Cell as a basic unit of function – cell theory	2	Power point
1.2	Prokaryotic cell	2	Power point
1.3	Eukaryotic cell	2	Power point
1.4	Ultra structure and functions of plant cell	2	Power point
1.5	Ultra structure and functions of animal cell	2	Power point
1.6	Cell wall -ultra structure, chemical nature, origin and functions.	2	Black/white board
1.7	Bio-Membrane- endomembrane structure fluid mosaic model.	4	Power point
2.1	Cell organelles	2	Power point
2.2	Ultra-structure and chemical composition of Mitochondria	2	Power point
2.2	Ultra-structure and chemical composition of Chloroplast.	3	Power point
2.3	Ultra-structure and chemical composition endoplasmic reticulum	3	Power point
2.4	Ultra-structure - microsomes,.	2	Black/white board
2.5	Golgi complex and lysosomes	4	Black/white board
2.6	Ribosomes.	3	Black/white board
2.7	Non-living inclusions or ergastic substances	3	Black/white board
2.8	Morphology and ultrastructure of Chromosomes - eukaryotic chromosomes.	4	Black/white board
2.9	Heterochromatin, euchromatin.	2	Black/white board
3.1	Nucleus, Nucleolus, Chromosomes, Nucleosome	3	Power point
3.2	Salivary gland and lamp brush chromosomes.	4	Power point
3.3	Cell cycle -Mitosis S-Phase, G1-phase, interphase,	4	Power point

	prophase, metaphase, anaphase, telophase,		
3.4	Mitogen, microtubules, tubulins,	2	Black/white board
3.5	Centromere, kinetochore and cytokinesis.	2	Black/white board
4.1	The reproductive cycle- Stages of meiosis, significance of meiosis:	4	Power point
4.2	Chromomere, synapsis, synaptonemal complex, synaptomeres, lateral element,	4	Black/white board
4.3	Central element, transverse elements, chiasma and recombination.	4	Black/white board
5.1	Numerical changes in chromosomes – Aneuploidy and Euploidy:-	4	Power point
5.2	Monosomy, nullisomy, trisomy, tetrasomy,	3	Power point
5.3	Down’s syndrome, autopolyploid, haploid, colchicines.	4	Black/white board
5.5	Gene mutations- causes, types.	4	Black/white board
5.6	Oncogenes, oncoproteins and cancers.	4	Power point
	Total hours	**90**	

Thiagarajar College (Autonomous): Madurai – 625 009
Department of Botany
(For those joined B.Sc. Biotechnology on or after June 2019)
Programme Code: UBT

Course Code	Course Title	Category	L	T	P	Credit
UBT19CL21	**Cell Biology 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 (according to Bloom's Taxonomy)
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 plasmalysis.	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
CO1	**S**	**L**	**S**	**L**	**L**
CO2	**L**	**M**	**L**	**S**	**M**
CO3	**L**	**L**	**M**	**L**	**L**
CO4	**S**	**S**	**S**	**M**	**S**

S-Strong M- Medium Low-Low

Title of the paper: Cell Biology 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.

Reference Manual/s:

Harris, N. and K. J. Oparka. 1994. Plant Cell Biology- A practical approach. IRL Press, OUP, Oxford.

Dixon, R. A. and R. A. Gonzales. 1994. Plant Cell Culture. A Practical Approach. Oxford University Press, Oxford.

Krishnamoorthy, K. V. 1988. Methods in Plant Histochemistry. Viswanathan publishers, Chennai, India.

Course Designed by:

Dr. K. Thangavel

Course contents and practical schedule

Exp. No.	Name of the Experiment	Practical hours	Teaching Method
1.	Observation of plant cells: onion peel, hydrilla leaf and stamina cells of Rheo.	2+2	Hands on training
2.	Observation of animal cells: epithelial cells	2	Hands on training
3.	Preparation of Root Tip squash and identification of stages in mitosis.	2	Hands on training
4.	Preparation of smear of anther and identification in meiosis	2	Hands on training
5.	Blood smear preparation: observation of different cells	2	Hands on training
6.	Determination of stomatal index	2	Hands on training
7.	Determination of Osmotic potential of cell sap using plasmolysis method	2	Hands on training
8.	Study of Non living inclusions: Starch grain of potato tuber, rice and banana.	2+2	Hands on training
9.	Cystolith of Ficus raphide of Acalypha, Crystals of dry onion peel	2+2	
10.	Haemocytometer – Cell counting	2	Hands on training
11.	Measurement of cell dimension by Micrometry.	2+2	Hands on training
Total hours			30

Thiagarajar College (Autonomous): Madurai – 625 009
Department of Botany
(For those joined B.Sc. Biotechnology on or after June 2019)

Programme Code: UBT

CourseCode	Course Title	Category	L	T	P	Credit
UBT19GE21	**Biomolecules**	**Generic Elective 2**	**4**	**-**	**-**	**4**

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

Preamble

Analyze 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 organization 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
CO1	**L**	**M**	**S**	**L**	**L**
CO2	**L**	**M**	**L**	**L**	**L**
CO3	**L**	**L**	**L**	**S**	**L**
CO4	**L**	**L**	**S**	**L**	**L**
CO5	**M**	**L**	**L**	**M**	**S**

S-Strong M- Medium L-Low

Blooms taxonomy

	CA		End of Semester
	First	Second	
Knowledge	**40%**	**40%**	**40%**
Understand	**40%**	**40%**	**40%**
Apply	**20%**	**20%**	**20%**
Total Marks	**52**	**52**	**140**

Title of the paper: Biomolecules

Unit: I

Carbohydrates: Structure and function of Monosaccharides (Glucose, fructose) – Disaccharides (Sucrose, lactose) – Cell wall polysaccharides (Cellulose, peptidoglycon) – 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 inhibhition – 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, 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:

- Zubay, G. 1993. Biochemistry, third edition. Won C. Brown publishers, London.
- Conn. E. E., P. K. Stumpf, G. Bruening and R.H. Doi, 1997. Out line biochemistry, John Wiley & sons Inc., New York, third edition.
- McKee and J.R. McKee, 1996. Biochemistry and introduction. Won C. Brown publishers, London.
- S.R. Mishra. 2003. Biomolecules. Discovery publishing house.

Reference Books:

- Stryer, L. 2000. Biochemistry, Fourth edition .W.H. Freeman and company, New York.
- Voet, and J. G. Voet, 1995. Biochemistry, fourth edition. John Wiley & Sons lnc, New York.
- Nelson, D. L. and M. M . Cox, 2002. Lehninger Principles of biochemistry, fourth edition. Worth publishers, New York.

Course designer

1. **S.Yogachitra**
2. **S.Siva Durga**

Course contents and lecture schedule

Unit	Topic	lecture hrs.	Method of Teaching
1.1	Carbohydrates: Structure and function of Monosaccharides (Glucose, fructose) – Disaccharides (Sucrose, lactose) – Cell wall polysaccharides (Cellulose, peptidoglycon) Storage polysaccharides (Starch, glycogen)	6	Black board
1.2	General account on chitin, pectin and lignin.	3	Black board
2.1	Aminoacids: General properties – Classification – based on polarity – protein and non-protein aminoacids.	4	Power point
2.2	Proteins – Structure , properties and functions of Protein	4	Black board
2.3	Primary structure , Secondary structure, tertiary and quarternary structure	4	Power point
3.1	Enzymes: Classification and nomenclature — Mechanism of enzyme action	6	Power point
3.2	Factors affecting enzyme action - enzyme inhibhition – Michaelis Menten constant-Theories on enzyme action	6	Black board
4.1	Structure and functions of Nucleic acids: Nucleosides – Nucleotides – Purines and pyrimidines – phosphodiester bonds-histones – role of histones in DNA packaging	5	Black board
4.2	DNA double helix (Watson & Crick Model) – A, B, Z forms of DNA	5	Black board
4.3	RNA types: mRNA, tRNA, rRNA, and hnRNA.	4	Power point
5.1	Lipids: Classification (outline) –Saturated and unsaturated fatty acids	4	
5.2	Simple non-saponifiable lipids: terpenes, steroids,sterols – Cholesterol, Ergosterol - phosphotidylcholine	4	Black board
5.3	Complex saponifiable lipids: triglycerides, phosphoglycerides - membrane lipids – lipoprotein complex	3	Power point
TOTAL HOURS		**60**	

Thiagarajar College (Autonomous): Madurai – 625 009
Department of Botany
(For those joined B.Sc. Biotechnology on or after June 2019)
Programmme Code :UBT

Course Code	Course Title	Category	L	T	P	Credit
UBT19GEL21	Analytical Biochemistry &Biomolecules Lab	**Generic Elective Lab2**	**-**	**-**	**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 (according to Bloom's Taxonomy)
CO1	Acquire knowledge on the measurement of pHi of aminoacids	K1
CO2	Apply the knowledge of quantitative estimationsof biomolecules	K3
CO3	Make use of the titration for the saponification of fats. .	K3
CO4	Experiment with the Enzyme kinetics	K3

K1 - Knowledge K2 - Understand K3 – Apply

Mapping of COs with POs

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

S-Strong M- Medium L-Low

Title of the paper: Biomolecules lab

1. Measurement of pHi of amino acid
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

TEXT BOOKS:

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

REFERENCE BOOKS:

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

Course designer S.YogachitraS.Siva Durga

Course contents and lecture schedule

Exp.No.	**Experiment**	**No of hrs.**	**Method of teaching**
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	

Thiagarajar College : Madurai – 625 009
Department of Botany
(For those joined B.Sc. Biotechnology on or after June 2019)
Programme Code:UBT

Course Code	Course Title	Category	L	T	P	Credit
UBT19C31	**Molecular Biology**	**Core-3**	**4**	**-**	**-**	**4**

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

Preamble

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

Course Outcomes

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

#	Course Outcome	Knowledge Level (according to Bloom's Taxonomy)
CO1	Acquire knowledge about structural conformation of DNA	K1
CO2	Summarize the various mechanisms in gene transfer.	K3
CO3	Analyze the replicatory mechanisms in prokaryotes &eukaryotes.	K2
CO4	Explain the mechanisms of transcription.	K1
CO5	Understand the mechanism of gene expression	K3

K1 - Knowledge K2 - Understand K3 - Apply

Mapping of COs with POs

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

S-Strong M- Medium L-Low

Blooms taxonomy

	CA		End of Semester
	First	**Second**	
Knowledge	**40%**	**40%**	**40%**
Understand	**40%**	**40%**	**40%**
Apply	**20%**	**20%**	**20%**
Total Marks	**52**	**52**	**140**

Title of the paper: MolecularBiology

Unit I:

Molecular basis of life, principle, scope and application. circular, nicked, super coiled & covalently closed circular DNA – DNA properties – DNA denaturation & renaturation kinetics - melting curve. Hyperchromicity, C-value paradox.

Unit: II

Gene transfer mechanism: Transformation, Conjugation & Transduction- transposable elements – IS elements – transposons. Mutation:- gene mutation – spontaneous and induced mutagenesis – Types of mutagens - molecular basis of mutation.

Unit :III

DNA Replication: Prokaryotic and Eukaryotic DNA replication – Role of replicating enzymes, four models of replication – Conservative, semi conservative, rolling circle model, unidirectional, bidirectional and Okazaki fragments.

Unit: IV

Mechanism of transcriptions: Transcription cycle in prokaryotes and Eukaryotes. Role of RNA polymerases in transcription. RNA splicing, Spliceosome machinery.

Unit: V

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

Text Books:

- Freifelder, D. 1990. Molecular Biology, 2nd edition. Narosa Publishing House, New Delhi.
- Turner, P. C. 2001. Plant Molecular Biology, 2nd edition. Bios scientific publishers, Oxford
- DeRobertis, E.D.P. and DeRobertis, E.M.F. 2006. Essentials of Cell and Molecular Biology. Holt Saunders Publication, Philadelphia..
- Lee, P. J. 1999. Plant Biochemistry and Molecular Biology, 2nd edition. John Wiley and Sons, New York.

Reference Books:

- James Watson, D. 2004. Molecular Biology of Gene, 5th edition. Pearson education publication, Singapore.
- Benjamin Lewin. 2008. Gene IX. Oxford university press, Oxford

Course designers:

1. **S.Yogachitra S.Siva Durga**

Course contents and lecture schedule

Unit	Topic	lecture hrs.	Method of teaching
1.1	Molecular basis of life, principle, scope and application.–	2	Black board
1.2	circular, nicked, super coiled & covalently closed circular DNA	4	powerpoint
1.3	DNA properties – DNA denaturation & renaturation kinetics - melting curve.	4	Black board
1.4	Hyperchromicity, C-value paradox.	5	Black board
2.1	Gene transfer mechanism: Transformation,.	2	Black board
2.2	Conjugation & Transduction- transposable elements – IS elements – transposons	4	Black board
2.3	Mutation:- gene mutation .	2	powerpoint
2.4	spontaneous and induced mutagenesis – Types of mutagens - molecular basis of mutation	4	powerpoint
3.1	DNA Replication: Prokaryotic and Eukaryotic DNA replication –	4	Black board
3.2	Role of replicating enzymes four models of replication – Conservative, semi conservative,	3	Black board
3.3	rolling circle model, unidirectional, bidirectional and Okazaki fragments	4	Black board
4.1	Mechanism of transcriptions: Transcription cycle in prokaryotes and Eukaryotes.	5	Black board
4.2	Role of RNA polymerases in transcription. RNA splicing, Spliceosome machinery	5	powerpoint
5.1	Translation; initiation, elongation and termination. Regulation of gene expression in Prokaryotes and Eucaryotes	4	Black board
5.2	lac, ara & trp operons – Catabolite repression in Eukaryotes–	4	powerpoint
5.3	Post transcriptional and post translational modifications - Hormonal regulations	4	powerpoint

Thiagarajar College : Madurai – 625 009
Department of Botany
(For those joined B.Sc. Biotechnology on or after June 2019)
Programme Code UBT

Course Code	Course Title	Category	L	T	P	Credit
UBT19C32	Basics of Computer and Bioinformatics	Core-4	4	-	-	4

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

Preamble

To provide the students with the basic knowledge on computer, components and types of computers and applications of bioinformatics tools in biological sciences.

Course Outcomes

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

#	Course Outcome	Knowledge Level (according to Bloom's Taxonomy)
CO1	Evaluate organization and components of computers.	K1
CO2	Distinguish different operating and software systems used in basic computers and computational biology.	K2
CO3	Demonstrate the applications of bioinformatics resources in teaching and research.	K2
CO4	Depict the applications of different biological science data bases.	K3
CO5	Illustrate the modes of nucleic acid and protein sequence analysis and their applications in phylogenetics.	K3

K1 - Knowledge K2 - Understand K3 - Apply

Mapping of COs with POs

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

S- Strong M- Medium L-Low

Blooms Taxonomy

	CA		End of Semester
	First	**Second**	
Knowledge	**40%**	**40%**	**40%**
Understand	**40%**	**40%**	**40%**
Apply	**20%**	**20%**	**20%**
Total Marks	**52**	**52**	**140**

Title of the paper: Basics of Computer and Bioinformatics

Unit I: Components of computer: input and output devices, storage devices, Graphic devices. Generation of computers -classification and characteristics of computers. Operating system: MS, DOS & Windows. Networks: Intranet, Internet –search engines; Google, yahoo.

Unit II. MS Word: Getting to know word - Basic text manipulation – formatting text -working with a document – automatic features – graphical features. MS Excel: worksheet basics – copy / move formatting cell referencing function – cell errors – workbook security – data analysis, Sum , Formulae format, Creation of charts – graphs. MS Power Point.

Unit III. Introduction, Scope and application of Bioinformatics – useful Bioinformatics web sites. Acquiring and using of public data bases. NCBI, Pubmed, EMBL, Swissprot, Entrez.

Unit IV. Databases: Types of databases – Biological databases. DNA data bases, Protein data base – primary, secondary and composite databases – Retrieval of data – FASTA, BLAST – types of Blast. Genome, mutation and SNP databases (polymorphism).

Unit V. Sequence analysis – DNA, protein sequence analysis. Sequence alignment – Multiple sequence analysis – CLUSTAL W. Phylogenetic analysis – Phylo draw. Analysis of 3D structure of DNA & Proteins using RASMOL.

Text Books

- Sundararajan, S. and R. Balaji. 2002. Introduction to Bioinformatics. Himalaya Publishing house, Bangalore.
- Kothekar, V. 2004. Introduction to Bioinformatics. Dhruv Publications, New Delhi.
- Sanjay Saxena. 2003. First course on computers. Vikas publishing house Pvt. Ltd., New Delhi.
- Raja Ram, F.V. 2003. Fundamentals of Computers. Printice – Hall of India Pvt. Ltd., New Delhi.
- Rawlings, R.J. 1986. Software Directory for Molecular Biologists. Stockton press, Mac Millan publishers, New Delhi.

Reference Books:

- Cohen, N.C. 2006. Guide book on molecular modeling in drug design. Elsevier, New Delhi.
- P.K. Singh. 2010. Basics of computer- V.K. (India) Enterprises. New Delhi.

Course designed by: Dr. K. Thangavel

Course contents and lecture schedule

Unit	Topic	Lecture hrs.	Method
1.1	Introduction- components of computers	2	Black board
1.2	Input and output devices, storage devices,	2	Power point
1.3	Graphic devices.	2	Power point
1.4	Generation of computers	2	Power point
1.5	Classification and characteristics of computers	2	Power point
1.6	Operating system: MS, DOS & Windows.	2	Power point
1.7	Networks: Intranet, Internet	2	
1.8	Search engines; Google, yahoo.	2	Power point
2.1	MS Word-getting to know word - Basic text manipulation – formatting text	4	Power point
2.2	Working with a document – automatic features – graphical features.	2	Power point
2.3	MS Excel: worksheet basics – copy / move formatting cell referencing function – cell errors – workbook security	2	Power point
2.4	Data analysis, Sum , Formulae format, Creation of charts – graphs. MS Power Point.	2	Power point
3.1	Introduction, scope and application of Bioinformatics	2	Power point
3.2	Useful Bioinformatics web sites.	2	Power point
3.3	Acquiring and using of public data bases. NCBI	2	Power point
3.4	Pubmed, EMBL	2	Power point
3.5	Swissprot, Entrez	2	Power point
4.1	Databases: Types of databases – Biological databases	4	Power point
4.2	DNA data bases	2	Power point
4.3	Protein data base – primary, secondary and composite databases	2	Power point
4.4	Retrieval of data – FASTA,	2	Power point
4.5	BLAST – types of BLAST..	2	Power point
4.6	Protein sequence analysis. Sequence alignment	2	Power point
4.7	Multiple sequence analysis – CLUSTAL W.	2	Power point
5.1	Sequence analysis – DNA sequence analysis.	2	Power point
5.2	Phylogenetic analysis – Phylo draw.	2	Power point
5.3	Analysis of 3D structure of DNA & Proteins using RASMOL.	4	Power point
Total hours			**60**

Thiagarajar College : Madurai – 625 009
Department of Botany
(For those joined B.Sc. Biotechnology on or after June 2019)
Programme Code- UBT

Course Code	Course Title	Category	L	T	P	Credit
UBT19CL31	**Molecular Biology & Basics of Computer and Bioinformatics Lab**	**Core lab-3**	**-**	**-**	**2**	**1**

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

Preamble

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

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

#	Course Outcome	Knowledge Level (according to Bloom's Taxonomy)
CO1	Apply the Knowledge of extraction procedures of DNA,RNA Acquire knowledge of Transformation experiments	K3
CO2	Use different types of computers, operating system for their scientific writings and presentations.	K1
CO3	Distinguish different operating and software systems used in basic computers and computational biology.	K2
CO4	Acquire Knowledge on conjugation	K2
CO5	Evaluate the applications of nucleic acid and protein sequence analysis tools in phylogenetics .	K3

K1 - Knowledge K2 - Understand K3 - Apply

Mapping of COs with POs

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

S-Strong M-Medium L-Low

Title of the paper: Molecular Biology & Basics of Computer and Bioinformatics Practical

A. Molecular Biology

1. Isolation of chromosomal DNA in E. coli
2. Isolation of RNA from leaf tissues
3. Isolation of plasmids from E.coli
4. Phage isolation
5. Transformation experiments in E.coli
6. Separation of protein by Polyacrylamide gel electrophoresis
7. Replica plating technique
8. Demonstration of Conjugation
9. Screening of Lactose utilizers
10. Gradient plate technique

REFERENCE BOOKS:

- Robert.F.Schleif.2003. Practical Methods In Molecular Biology. First Edition. Springer, New York.

B. Basics of Computer and Bioinformatics

1. Formatting text: i) editing-moving and coping text ii) paragraph formatting-left alignment, Right alignment, center alignment and justification. iii) spacing and margins-single line spacing, double line spacing. Paragraph spacing iv) indent-First line indent, hanging indent.
   Use of symbols and pictures: v) effects-subscripts, superscripts vi) All caps and Dropped caps vii) spell check-grammar check..i) create a table-nUBTer of columns ii) insert a row and delete a column iii) splitting and merging cells iv) sort the table v) prepare the chart using the database.

2. Formatting document: I) borders and shading ii) find and replace iii) date and time iv) formatting characters –bold, italics, underline v) bullets and nUBTering.

3. M S excel: worksheet i) creating worksheet ii) inserting column and deleting a row iii) selecting cells iv) selecting rows and columns v) saving a worksheet vi) cut copy paste.

4. Maths functions: sum, max, min, average. Creating a chart using database. Power point – simple presentation – sound effect – animation.
5. Bioinformatics-Retrieval of databases. Searching: sequences, sequence analysis – protein, DNA (FASTA), BLAST P, BLASTn.

Reference Manual/s:

- Davies. J.M. 1995. Genome Analysis – A Practical Approach, Oxford University Press. Oxford.
- Link A.L., 1998 2-D Proteome Analysis Protocols, Human press, Totowa, NJ.
- P.K. Singh. 2010. Basics of computer- V.K. (India) Enterprises. New Delhi.

Course Designed by:

S. SivaduragaDr. K. Thangavel

Course contents and practical schedule

Exp. No.	Name of the Experiment	Practical hours	Teaching Method
	A. Molecular Biology		
A1.	Isolation of chromosomal DNA in E. coli	1	Hands on Training.
A2.	.Isolation of RNA from leaf tissues	1	Hands on Training.
A3.	Isolation of plasmids from E.coli	2	Hands on Training
A4.	Phage isolation	1	Hands on Training.
A5.	Transformation experiments in E.coli	2	Demonstration
A6.	Separation of protein by Polyacrylamide gel electrophoresis	2	Hands on Training.
A7.	Replica plating technique	1	Hands on Training.
A8.	Demonstration of Conjugation	1	Demonstration
A9.	Screening of Lactose utilizers	2	Hands on Training.
A10.	Gradient plate technique	2	Demonstration
	B.Basics of Computer and Bioinformatics		
B1.	Formatting text -editing-moving and coping text	1	Hands on training
B2.	Paragraph formatting-left alignment, Right alignment, center alignment and justification.	1	Hands on training
B3.	Spacing and margins-single line spacing double line spacing. Paragraph spacing. Indent-First line indent, hanging indent.	1	Hands on training
B4.	Use of symbols and pictures scientific writings and presentations -effects-subscripts, superscripts vi) All caps and Dropped caps - spell check-grammar check.	2	Hands on training
B5.	Tables-nUBTer of columns - inserts a row and delete a column -splitting and merging cells - sort the table-prepare the chart using the database.	1+1	Hands on training
B6.	Formatting document -borders and shading - find and replace - date and time - formatting characters –bold, italics, underline - bullets and nUBTering.	1+1	Hands on training
B7.	MS excel-worksheet- creating worksheet - inserting column and deleting a row - selecting cells- selecting rows and columns- saving a worksheet - cut copy paste.	2	Hands on training
B8.	Retrieval of database –Searching sequences, sequence analysis – protein, DNA	2	Hands on training
B9.	FASTA, BLAST P, BLASTn	2	Hands on training
Total hours:			**30**

Thiagarajar College : Madurai – 625 009
Department of Botany
(For those joined B.Sc. Biotechnology on or after June 2019)
Programme Code UBT

Course Code	Course Title	Category	L	T	P	Credit
UBT19GE31	**Genetics and Biostatistics**	**Generic Elective 3**	**4**	**-**	**-**	**4**

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

Preamble

Critical understanding of mechanism of inheritance and interaction of genes. Analyze biological data with statistical approach

Course Outcomes

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

#	Course Outcome	Knowledge Level
CO1	Analyze the various concepts involved in Mendelian Genetics.	K1
CO2	Apply the concept of multiple allelic inheritance.	K3
CO3	Elaborate the importance of extra chromosomal inheritance.	K2
CO4	Demonstrate the process of linkage.	K3
CO5	Learn the various statistical principles and methods in biology.	K1

K1 - Knowledge K2 - Understand K3 - Apply

Mapping of COs with POs

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

S-Strong M-Medium L-Low

Blooms taxonomy

	CA		End of Semester
	First	Second	
Knowledge	**40%**	**40%**	**40%**
Understand	**40%**	**40%**	**40%**
Apply	**20%**	**20%**	**20%**
Total Marks	**52**	**52**	**140**

Title of the paper: Genetics and Biostatistics

Unit: I

Mendelian Genetics: Mendel‘s laws – monohybrid and dihybrid crosses – test cross and backcross– Incomplete dominance & Co-dominance. Interaction of genes: Supplementary genes (9:3:4), Dominant Epistasis (12:3:1.), Duplicatory genes (15:1).

Unit: II

Multiple alleles: Blood group inheritance in humans Rh & ABO incompatibility. Erythroblastosis foetalis, Polygenic inheritance: Wheat kernel color and Ear length in maize. Sex determination: XO, XY, ZW & ZO, methods, Genic balance concept - Sex determination in plants.

Unit: III

Extra chromosomal inheritance: Plastid color inheritance in plants, kappa particles of *Paramaecium*, coiling in snail and streptomycin sensitivity in algae. Sex linked inheritance: X – linked - eye color in *Drosophila*, color blindness in man – Hemophilia, Y- linked inheritance: Ear , Hypertrichosis. Sex limited inheritance: Breast. Sex influenced inheritance: Baldness and length of index finger.

Unit: IV

Linkage & crossing over: Mechanism of linkage - Complete & incomplete linkages. Linkage in maize –Crossing over mechanism, theories explaining mechanism of crossing over- types: Simple, Double & Multiple crossing over – importance of crossing over- interference and coincidence – gene mapping – population Genetics

Unit: V

Biostatistics: Collection, Classification tabulation, graphic and diagrammatic presentation of data – Measures of central tendency: mean, mode and median; Measures of dispersion - Range and Standard deviation. Standard error. Correlation and regression analysis – chi square test. Student t test. One way ANOVA.

Text Books:

- Sarin, C.1989. Genetics. Tata McGraw- Hill Publishing company Ltd. New Delhi.
- Palanichamy, S. and M. Manoharan. 1994. Statistical Methods for Biologists. Palani Paramount Publications, Palani.
- Gupta, S. P. 2012. Statistical methods, 9th edition. S. Chand & Sons Publishers, New Delhi.

Reference Books:

- Strickberger, M.W., 2008. Genetics, 3rd Ed., MacMillan Publishing, New York.
- Gardner, E.J. and J. Michael Simmons. 2006. Principle of genetics 8th edition, John Wilely & Sons, New York.

Course designers:

1. **S.Yogachitra**
2. **S.Siva Durga**

Course contents and lecture schedule

Unit	Topic	No of lecture hrs.	Method of Teaching
1.1	Mendelian Genetics: Mendel‘s laws – monohybrid and dihybrid crosses – test cross and backcross– Incomplete dominance & Co-dominance.	2	Power Point
1.2	Interaction of genes: Supplementary genes (9:3:4), Dominant Epistasis (12:3:1.), Duplicatory genes (15:1).	4	Black Board
2.1	Multiple alleles: Blood group inheritance in humans Rh & ABO incompatibility. Erythroblastosis foetalis,	4	Power Point
2.2	Polygenic inheritance: Wheat kernel color and Ear length in maize	4	Power Point
2.3	Sex determination: XO, XY, ZW & ZO, methods	4	Black Board
2.4	Genic balance concept - Sex determination in plants.	3	Power Point
3.1	Extra chromosomal inheritance: Plastid color inheritance in plants, kappa particles of *Paramaecium*, coiling in snail and streptomycin sensitivity in algae	4	Power Point
3.2	Sex linked inheritance: X – linked - eye color in *Drosophila,* color blindness in man – Hemophilia, Y-linked inheritance: Ear , Hypertrichosis	3	Black Board
3.3	Sex limited inheritance: Breast	2	Black Board
3.4	Sex influenced inheritance: Baldness and length of index finger	4	Power Point
4.1	Linkage & crossing over: Mechanism of linkage - Complete & incomplete linkages	4	Power Point
4.2	Linkage in maize –Crossing over mechanism	3	Power Point
4.3	theories explaining mechanism of crossing over- types Simple, Double & Multiple crossing over – importance of crossing over-	2	Black Board
4.4	interference and coincidence – gene mapping – population Genetics	4	Power Point
5.1	Biostatistics: Collection, Classification tabulation, graphic and diagrammatic presentation of data	2	Black Board
5.2	Measures of central tendency: mean, mode and median	4	Black Board
5.3	Measures of dispersion - Range and Standard deviation	2	Power Point
5.4	Standard error. Correlation and regression analysis	3	Black Board
5.5	chi square test. Student t test. One way ANOVA	3	Black Board
Total Hours		**60**	

Thiagarajar College : Madurai – 625 009
Department of Botany
(For those joined B.Sc. Biotechnology on or after June 2019)
Programme Code -UBT

Course Code	Course Title	Category	L	T	P	Credit
UBT19GL41	**Genetics and Biostatistics Lab**	**Generic Elective lab 3**	**-**	**-**	**2**	**-**

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

PREAMBLE

Acquire knowledge on problem solving in Genetics. Solve problems in measures of central tendency and dispersion.

Course Outcomes

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

#	Course Outcome	Knowledge Level (according to Bloom's Taxonomy)
CO1	Acquire Knowledge on Mendelian Genetics	K1
CO2	Apply knowledge of problem solving in interaction of genes	K3
CO3	Experiment with the concepts of multiple alleles.	K3
CO4	Make use of the knowledge in Biostatistics	K3

Mapping of COs with POs

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

S-Strong M-Medium L-Low

Title of the paper: Genetics and Biostatistics lab

1. Problems in Monohybrid cross
2. Problems in Dihybrid cross,
3. Problems in Test cross,
4. Problems in Back cross

5. Problems in Incomplete dominance.
6. Problems in interaction of genes
7. Problems in multiple alleles
8. Problems in sex determination and sex linkage

9. Problems in linkage and three point test cross
10. Problems in cytoplasmic inheritance.
11. Problems in Mean , Median , Mode
12. Problems in Standard Deviation
13. Problems in Chi square Test

TEXT BOOKS:

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

REFERENCE BOOKS:

- Richard .D. Kowles. Solving Problems in Biostatistics. Springer, New York.

Course designers:

1. **S.YogachitraS.Siva Durga**

Course contents and lecture schedule

S.No.	**Experiment**	**lecture hrs.**	**Method of teaching**
1	Problems in Monohybrid cross	3	Hands on Training.
2	Problems in Dihybrid cross	3	Hands on Training.
3	Problems in Test cross	2	Hands on Training
4	Problems in Back cross	2	Hands on Training.
5	Problems in Incomplete dominance	2	Hands on Training.
6	Problems in interaction of genes	2	Hands on Training.
7	Problems in multiple alleles	3	Hands on Training.
8	Problems in sex determination and sex linkage	2	Hands on Training.
9	Problems in linkage and three point test cross	2	Hands on Training.
10	Problems in cytoplasmic inheritance	2	Demonstration
11	Problems in Mean , Median , Mode	3	Demonstration
12	Problems in Standard Deviation	2	Demonstration
13	Problems in Chi square Test	2	Demonstration
	Total Hours	30	

Thiagarajar College : Madurai – 625 009
Department of Botany
(For those joined B.Sc. Biotechnology on or after June 2019)
Programme Code -UBT

Course Code	Course Title	Category	L	T	P	Credit
UBT19NE31	**Food Processing Technology**	**NME1**	**2**	**-**	**-**	**2**

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

Preamble

Develop suitable skills involved in the mushroom cultivation, microbial protein production. Trained in Food processing technology.

Course Outcomes

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

#	Course Outcome	Knowledge Level (according to Bloom's Taxonomy)
CO1	Acquire basic knowledge on cultivation of mushrooms.	K1
CO2	Appreciate the medicinal value of mushrooms.	K2
CO3	Make use of knowledge in food processing technology	K3
CO4	Develop knowledge to occupy oneself during leisure time.	K3

K1 - Knowledge K2 - Understand K3 - Apply

Mapping of COs with POs

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

S-Strong M-Medium L-Low

Blooms taxonomy

	CA		End of Semester
	First	Second	
Knowledge	**40%**	**40%**	**40%**
Understand	**40%**	**40%**	**40%**
Apply	**20%**	**20%**	**20%**
Total Marks	**30**	**30**	**65**

Title of the paper: Food Processing Technology

Unit I:
Mushroom technology: spawn preparation and cultivation methods of Pleurotus sp. And Agaricus sp Nutritional and Medicinal value of mushrooms –Delicious mushroom recipe.

Unit II:
Vegetable and fruit processing technology Preparation of jam, jelly, squash and pickle. Preservation: low temperature, high temperature chemical preservation. Milk products: Cheese production technology.

Text book:

- Casida, L. E. 2015. Industrials Microbiology. New age International publication. New Delhi.
- Frazier, P.C and P.C. Weathoft ..1988. Food Microbiology. Compass Ltd, New Delhi.
- Nita Bahl. 1994, 3rd edition. Hand Book on Mushrooms. Oxford & IBH Publishing Ltd, New Delhi.

Reference Books:

- Kapoor, J.N.2014. Mushroom cultivation ICAR. New Delhi.
- Banwari George, J. 1998. Basic food microbiology, 2nd Edition. CBS publishers and distributors, New Delhi.
- Aneja, K.R. 1996. Experiments in Microbiology, Plant pathology. Tissue culture and Mushroom cultivation. Wishwa Prakashan, (New Age International (p) Ltd), New Delhi

Course designer

1. **S. Siva Durga**
2. **S.Yogachitra**

Course contents and lecture schedule

Unit	Topic	No of lecture hrs.	Method of Teaching
1.1	Mushroom technology: spawn preparation and cultivation methods of Pleurotus sp. And Agaricus sp Nutritional	6	Black Board
1.2	Medicinal value of mushrooms	4	Black Board
1.3	Delicious mushroom recipe.	4	Black Board
2.1	Vegetable and fruit processing technology Preparation of jam, jelly, squash and pickle	6	Power Point
2.2	Preservation: low temperature, high temperature chemical preservation.	5	Black Board
2.3	Milk products: Cheese production technology.	5	Power Point
	Total Hours	30	

Thiagarajar College : Madurai – 625 009
Department of Botany
(For those joined B.Sc. Biotechnology on or after June 2019)
Programme Code- UBT

Course Code	Course Title	Category	L	T	P	Credit
UBT19C41	**IMMUNOLOGY**	**Core-5**	**4**	**-**	**-**	**4**

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

Preamble

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

Course Outcomes

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

#	Course Outcome	Knowledge Level (according to Bloom's Taxonomy)
CO1	Understand the organizational, functional signification of lymphoid organs.	K2
CO2	Analyze the mechanism of immunity.	K1
CO3	Make use of immunization practices.	K3
CO4	Acquire knowledge on various immunological pathways.	K1
CO5	Make use of immunotechniques	K3

K1 - Knowledge K2 - Understand K3 - Apply

Mapping of COs with POs

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

S-Strong M-Medium L- Low

Blooms taxonomy

	CA		End of Semester
	First	**Second**	
Knowledge	**40%**	**40%**	**40%**
Understand	**40%**	**40%**	**40%**
Apply	**20%**	**20%**	**20%**
Total Marks	**52**	**52**	**140**

Title of the paper: Immunology

Unit: I
Elements of immunology – Primary and secondary lymphoid organs, Thymus, Bone marrow, Bursa of Fabricus, lymph node and spleen. Cells of the lymphorecticular system. Immunoglobulins - structure, functions, classes, isotypes, allotypes and idiotypes. Antibody diversity- Mechanism contributing diversity. Class switching.

UNIT: II
Types of immunity: innate and acquired immunity – active and passive immunity - Humoral immunity and cell-mediated immunity. Cytokines. T-cell and B -cell receptors. Antigen, antigenicity, epitopes and haptens . Antigen processing and presentation. Immunological memory –immunological tolerance.

UNIT: III
Immunization practices- (Active and passive immunization), Vaccines: - Toxoids, killed and attenuated vaccines, Recombinant vaccines, subunit vaccines, antiidiotypic antibodies, chimeric antibodies and plantibodies. Monoclonal antibodies - production and applications.

UNIT: IV
Complement system, components, nomenclature, and activation of complement-classical and alternate pathway. MHC complex-gene organization. HLA genes class I & class II antigens: structure and function - Histocompatibility testing.

UNIT: V
Hypersensitivity and types. Autoimmunity – Autoimmune disease - . Immunodeficiency disease - AIDS. Radio immunoassay. ELISA, Complement fixation test. Transplantation-types, graft versus host reactions.

Text Books:

- Rao, C.V. 2002, 2nd edition. Introduction to Immunology. Narosa publishing House, Delhi.
- Abbas, L. And Prber. 1997. Essentials of Immunology. W.B Saunders Company New York
- Tizard, I. R. 1998. Immunology: An Introduction, 4th edition. W.B.Saunders Company, Philadelphia

Reference Books:

- Abbas, A.K. 2004. Basic immunology 2nd edition. Saunders- Eilsevier, Philadelphia.
- Kubey, 1997. Immunology 3rd edition. Freeman Publishers , New York.
- Klaus. D. Elgert. 2009. Immunology: Understanding the immune system. Wiley – Blackwell inc.

Course designer

1. **S.Siva Durga**
2. **S.Yogachitra**

Course contents and lecture schedule

Unit	**Topic**	**No of lecture hrs.**	**Method of teaching**
1.1	Elements of immunology – Primary and secondary lymphoid organs, Thymus, Bone marrow, Bursa of Fabricus, lymph node and spleen	3	Powepoint
1.2	Cells of the lymphorecticular system	3	Black board
1.3	Immunoglobulins - structure, functions, classes, isotypes, allotypes and idiotypes.	4	Black board
1.4	Antibody diversity- Mechanism contributing diversity. Class switching.	4	Black board
2.1	Types of immunity: innate and acquired immunity – active and passive immunity - Humoral immunity and cell-mediated immunity	5	Black board
2.2	Cytokines. T-cell and B -cell receptors.	4	Black board
2.3	Antigen, antigenicity, epitopes and haptens	2	Black board
2.4	Antigen processing and presentation	3	Powerpoint
2.5	Immunological memory –immunological tolerance	4	Black board
3.1	Immunization practices- (Active and passive immunization)	2	Black board
3.2	Vaccines: - Toxoids, killed and attenuated vaccines, Recombinant vaccines, subunit vaccines	5	Powerpoint
3.3	antiidiotypic antibodies, chimeric antibodies and plantibodies	3	Black board
3.4	Monoclonal antibodies - production and applications	2	Powerpoint
4.1	Complement system, components, nomenclature, and activation of complement-classical and alternate pathway	3	Black board
4.2	MHC complex-gene organization	3	Black board
4.3	HLA genes class I & class II antigens: structure and function - Histocompatibility testing	2	Black board
5.1	Hypersensitivity and types	3	Black board
5.2	Immunodeficiency disease - AIDS. Radio immunoassay	2	Black board
5.3	ELISA, Complement fixation test.	1	Powerpoint
5.4	Transplantation-types, graft versus host reactions.	2	Black board
	Total hours	45	

Thiagarajar College : Madurai – 625 009
Department of Botany
(For those joined B.Sc. Biotechnology on or after June 2019)
Programme Code -UBT

Course Code	Course Title	Category	L	T	P	Credit
UBT19C42	Clinical Laboratory Technology	Core-6	4	-	-	4

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

Preamble

Acquire knowledge on different factors influencing normal health and disease conditions. Experiment with techniques of analysing body cells, fluids and methods of diagnosis of diseases.

Course Outcomes

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

#	Course Outcome	Knowledge Level (according to Bloom's Taxonomy)
CO1	Explain different parameters involved in hematology.	K3
CO2	Experiment with various biochemical parameters.	K3
CO3	Apply the knowledge of serology.	K3
CO4	Examine the different methods of analyzing urine.	K3
CO5	Categorize the importance of various body fluids.	K2

K1 - Knowledge K2 - Understand K3 - Apply

Mapping of COs with POs

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

S -Strong M- Medium L- Low

Blooms taxonomy

	CA		End of Semester
	First	Second	
Knowledge	40%	40%	40%
Understand	40%	40%	40%
Apply	20%	20%	20%
Total Marks	52	52	140

Title of the paper: Clinical Laboratory Technology

Unit I

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

Unit II

Biochemistry: Blood glucose-Oral Glucose Tolerance Test(OGTT), Lipid profile-Total serum cholesterol,High Density Lipoprotein (HDL),Low density lipoprotein(LDL),Renal profile-Blood Urea Nitrogen(BUN), Creatinine, Uric acid. Liverprofile - Bilirubin.

Unit III:

Serology: Widal test, VDRL, Rheumatoid factor, A.S.O. titre,C-Reactive Protein , Blood culture and sensitivity. Thyroid Function Test(TFT)-Total Thyroxine(T4),Triiodo thyronine(T3)

Unit IV

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

Unit V:

Stool examination: Color-microscopic examination, Cerebrospinal Fluid-appearance-cytology – chemistry, Sputum – Microbial analysis, Culture and sensitivity. Semen analysis-physical properties-Microscopic examination.

Text Book:

- Sood, R, 1999, Medical Laboratory Technology – methods and interpretations – Fifth edition, Jaypee, New Delhi.
- Mukherjee, L.K. 1988, Medical Laboratory Technology – Vol.3 – 2nd ed. – Hill Publishing Ltd., New Delhi.
- Connie R. Mahon. Diane G. Tice. 2006. Clinical Laboratory Immunology. 8th edition. Pearson Prentice Hall. 325 pp.

Reference Books:

- Rapael, S.S, 1983, Lynch Medical Laboratory Technology, Fourth edition, W.B. Saunders Co, Singapore.
- Woohan, I.D.P., Heather Freeman, 1990, Micro Analsis in Medical biochemistry, sixth edition, Churchil Livingstone Publishing Ltd., USA.
- John Ridley 2010. Essentials of clinical laboratory science. CLIA. Compliance guide.
- Ochei, J and Kolhattar, A. 2000. Medical Laboratory Science – Theory and Practice. Tata Mc Graw - Hill Publishing Company Ltd., New Delhi. India.

Course designer

1. **S.Siva Durga**
2. **S.Yogachitra**

Course contents and lecture schedule

	Topic	No of lecture hrs.	Methods of Teaching
1.1	Hematology: Composition of Blood – Plasma and corpuscles – cell study	4	Black Board
1.2	Counting of cells – TC and DC, Platelets, ESR, Hb, BT & CT.	6	Power Point
1.3	Blood Banking: Rh Typing – Slide test, Blood transfusion	3	Black Board
1.4	Compatibility testing. Blood culture and sensitivity.	3	Black Board
2.1	Biochemistry: Blood glucose-Oral Glucose Tolerance Test(OGTT),	4	Black Board
2.2	Total serum cholesterol,High Density Lipoprotein (HDL),Low density lipoprotein(LDL),Renal profile	4	Power Point
2.3	Blood Urea Nitrogen(BUN), Creatinine, Uric acid. Liverprofile - Bilirubin.	6	Power Point
3.1	Serology: Widal test, VDRL, Rheumatoid factor, A.S.O. titre,C-Reactive Protein	6	Black Board
3.2	Blood culture and sensitivity	2	Black Board
3.3	Thyroid Function Test(TFT)-Total Thyroxine(T4),Triiodo thyronine(T3)	4	Black Board
4.1	Urine Examination: Physical properties of Urine – Colour, Volume, Specific gravity, Odour, Turbidity and pH.	3	Black Board
4.2	Chemical examination – urine sugar, albumin, bile salts, Bile pigments, urobilinogen	3	Power Point
4.3	Microscopic Examination of Urine deposits – Cast Crystals – Cells.	2	Black Board
4.4	Principles in Pregnancy Test. Microbial culture and sensitivity.	2	Black Board
5.1	Stool examination:Color-microscopic examination, Cerebrospinal Fluid-appearance-cytology – chemistry	3	Black Board
5.2	Sputum – Microbial analysis, Culture and sensitivity.	2	Black Board
5.3	Semen analysis-physical properties-Microscopic examination.	3	Black Board
	Total Hours	60	

Thiagarajar College : Madurai – 625 009
Department of Botany
(For those joined B.Sc. Biotechnology on or after June 2019)
Programme Code -UBT

Course Code	Course Title	Category	L	T	P	Credit
UBT19GE41	Physiology	Generic Elective 4	4	-	-	4

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

Preamble

To inculcate the students with the basic information about the physiology of plants and animals and their roles in functioning of an organism.

Course Outcomes

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

#	Course Outcome	Knowledge Level
CO1	Elucidate different physiological and biochemical mechanisms in plants and animals and their adaptations.	K1
CO2	Assess the role of different biopathways involved in plants.	K2
CO3	Analyze the importance of each component of a system in performing the physiological functions.	K2
CO4	Understand the role of organs and organ system involved in the physiology of human.	K2
CO5	Depict a comparative study of the physiology	K2

K1 - Knowledge K2 - Understand K3 - Apply

Mapping of COs with POs

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

S -Strong M- Medium L- Low

Blooms taxonomy

	CA		End of Semester
	First	Second	
Knowledge	40%	40%	40%
Understand	40%	40%	40%
Apply	20%	20%	20%
Total Marks	52	52	140

Title of the paper: Physiology

UNIT I

Diffusion, osmosis, Water potential and its components – Absorption of water: apoplast and symplast concept – active and passive mechanism – Transpiration: Mechanism of opening and closing of stomata (theory of K+ Transport and hormonal regulation only). Absorption of minerals: Mechanism (Carrier concept Only) – Translocation of organic solutes: Mechanism (electro osmotic theory only)

UNIT II

Photosynthesis - Cyclic and non-cyclic photophosphorylation. Carbon fixation: C3, C4 and CAM pathways – Photorespiration. Respiration: Respiratory substrates – RQ – Aerobic respiration – Glycolysis – TCA cycle – Electron transport and oxidative phosphorylation – pentose phosphate pathway. Respiration: Respiratory organs – Physiology of respiration

UNIT III

Structure and functions of digestive glands - (Salivary, Gastric, Intestinal, Liver and Pancreas), gastrointestinal hormones, Digestion and absorption of proteins, carbohydrates and lipids.

Respiration-external respiration; respiratory movements, breathing; ventilation; process of gaseous exchange; respiratory pigments

UNIT IV

General functions of blood, blood cells; blood group ;blood vascular system; heart beat and functioning of heart; cardiac cycle ;regulation of heart beat; heart sound; blood pressure;blood clotting mechanism.

UNIT V

Muscle system-ultra structure of muscle fibres, mechanism of muscle contraction-biochemical changes during contraction. Nervous system, CNS and ANS; neurons; propagation of nerve impulses- synaptic transmission.

Text books

1. Bijlani, R.L. 2001. Fundamentals of Physiology. I edn. JayPee brothers, New Delhi

2. Subrahmanyam, S., Madhavankutty, K. and Singh, H.D. 1996 (Eds). Text Book of Human Physiology. S. Chand & Company Ltd. New Delhi.

Reference Books

1. Clancy, J. and Mc Vicar, A.J. 1995. Physiology and anatomy. Edward Arnold, London.

2. Fox, S.I. 1999. Human Physiology. VI edn. Mc Graw-Hill Publications, New Delhi.

3. Hoar W.S 2004. General and Comparative Physiology. Prentice-Hall (P) Ltd.New Delhi

4. Joshi, A.S. 1998. Human Physiology. VI Edn., The Benjamin/Cummings Publishing Company, California

Course Designer: G. Ramya vaideki

Course contents and lecture schedule

Unit	Topic	lecture hrs.	Teaching Method
1.1	Diffusion, osmosis, Water potential and its components – Absorption of minerals: Mechanism (Carrier concept Only) –)	2	PowerPoint
1.2	Absorption of water: apoplast and symplast concept – active and passive mechanism	4	Black board
1.3	Transpiration: Mechanism of opening and closing of stomata (theory of K+ Transport and hormonal regulation only).	4	PowerPoint
2.1	Translocation of organic solutes: Mechanism (electro osmotic theory only	5	PowerPoint
2.2	Photosynthesis - Cyclic and non-cyclic photophosphorylation.	2	Black board
2.3	Carbon fixation: C3, C4 and CAM pathways – Photorespiration. Respiration: Respiratory substrates – RQ – Aerobic respiration – Glycolysis	4	Black board
2.4	TCA cycle – Electron transport and oxidative phosphorylation, pentose phosphate pathway.	2	Black board
2.5	Respiration: Respiratory organs – Physiology of respiration	4	PowerPoint
3.1	Structure and functions of digestive glands - (Salivary, Gastric, Intestinal, Liver and Pancreas), gastrointestinal hormones,	4	PowerPoint
3.2	Digestion and absorption of proteins, carbohydrates and lipids.	3	Black board
3.3	Respiration-external respiration; respiratory movements, breathing; ventilation process of gaseous exchange; respiratory pigments	4	PowerPoint
4.1	General functions of blood, blood cells; blood group ;blood vascular system; heart beat and functioning of heart;	5	Black board
4.2	cardiac cycle ;regulation of heart beat; heart sound; blood pressure;blood clotting mechanism.	5	Black board
5.1	Muscle system-ultra structure of muscle fibres, mechanism of muscle contraction-biochemical changes during contraction	4	Black board
5.2	Nervous system, CNS and ANS ,neurons	4	PowerPoint
5.3	propagation of nerve impulses- synaptic transmission.	4	PowerPoint
		Total	**60**

Thiagarajar College : Madurai – 625 009
Department of Botany
(For those joined B.Sc. Biotechnology on or after June 2019)
Programme Code -UBT

Course Code	Course Title	Category	L	T	P	Credit
UBT19CL42	**Immunology and Clinical Laboratory Technology lab**	**Core Lab 4**	**-**	**-**	**2**	**1**

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

PREAMBLE

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

Course Outcomes

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

#	Course Outcome	Knowledge Level (according to Bloom's Taxonomy)
CO1	Acquire Knowledge on cellular components of blood. Acquire knowledge on normal blood glucose .	K1
CO2	Apply knowledge of analysis of differential cell count. Apply the knowledge on the measurement of bleeding and clotting time.	K3
CO3	Make use of the knowledge in analysis of biochemistry of blood and urine.	K3
CO4	Make use of the knowledge in preparation of cellular antigen,complement.Experiment with WIDAL.	K3

Mapping of COs with POs

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

S -Strong M- Medium L- Low

Title of the paper: Immunology and Clinical Laboratory Technology lab

Immunology

1. Total RBC count
2. Observation of different white blood cells.
3. Differential cell count
4. Preparation of complement
5. Preparation of serum
6. Isolation of DNA from human blood
7. Electrophoretic separation of serum protein
8. Haemagglutination
9. Blood grouping and Rh typing
10. Diffusion techniques;-single immuno diffusion technique
11. Double immuno diffusion technique
12. Antibacterial activity of Serum
13. Hemolysis
14. Counter current electrophoresis.

Clinical Laboratory Technology

1. WIDAL test
2. Measurement of Bleeding time and Clotting time
3. Culture analysis of Urine and blood
4. Physical and microscopic examination of urine
5. Erythrocyte Sedimentation Rate(ESR)
6. Pregnancy test
7. VDRL
8. Estimation of cholesterol

Course designer

1. **S.Siva Durga**
2. **S.Yogachitra**

TEXT BOOKS:

- Gupta. Talwar.2006. AHandbook of Practical and Clinical Immunology.CBS publishers, India.
- Hannah D.Zane.2001. Immunology, Theoretical and Practical Concepts in Laboratory Medicine .Saunders Publishers, UK.

REFERENCE BOOKS:

- Frank C. Hay,Westwood.2002. Practical Immunology. Wiley- Blackwell, UK. Blood glucose(Fasting and Post Prandial). **Course contents and lecture scheduleTEXT BOOKS:**

- Krishna Das.KV.2013. Clinical Medicine, A Text Book of Clinical Methods and Laboratory Investigations. Jaypee publishers, Chennai.
- Harold Varley .2005. Practical Clinical Biochemistry. Fourth Edition.CBS publishers, India.
- Baker.F.J, Selverton.R.E .Introduction To Medical Laboratory Technology. Seventh Edition. Elsievier, USA.
- Sainani G. S.,Rajesh G Sainani. 2018. A Manual of Clinical and Practical Medicine. Second Edition. Jaypee Publishers, Chennai.

Course contents and lecture schedule

S.No.	**Experiment**	**No of hrs.**	**Method of teaching**
	Immunology		
1	Total RBC count	1	Hands on Training
2	Observation of different white blood cells.	1	Hands on Training.
3	Differential cell count	1	Hands on Training
4	Preparation of complement	1	Hands on Training.
5	Preparation of serum	1	Hands on Training.
6	Isolation of DNA from human blood	2	Hands on Training.
7	Electrophoretic separation of serum protein	1	Hands on Training.
8	Haemagglutination	1	Hands on Training.
9	Blood grouping and Rh typing	1	Hands on Training.
10	Diffusion techniques;-single immuno diffusion technique	1	Demonstration
11	Double immuno diffusion technique	1	Demonstration
12	Antibacterial activity of Serum	1	Demonstration
13	Hemolysis	1	Demonstration
14	Counter current electrophoresis	1	
	Clinical Laboratory Technology		
1	Blood glucose(Fasting and Post Prandial)	2	
2	WIDAL tes	2	Hands on Training.
3	Measurement of Bleeding time and Clotting time	1	Hands on Training
4	Culture analysis of Urine and blood	2	Hands on Training.
5	Physical and microscopic examination of urine	1	Hands on Training.
6	Erythrocyte Sedimentation Rate(ESR)	2	Hands on Training.
7	Pregnancy test	1	Hands on Training.
8	VDRL	2	Hands on Training.
9	Estimation of cholesterol	2	Hands on Training.
	Total Hours	30	

Thiagarajar College : Madurai – 625 009
Department of Botany
(For those joined B.Sc. Biotechnology on or after June 2019)
Programme Code -UBT

Course Code	Course Title	Category	L	T	P	Credit
UBT19GL41	**Genetics and Biostatistics & Physiology Lab**	**Generic Elective** lab	**-**	**-**	**2**	**2**

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

Preamble

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

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

#	Course Outcome	Knowledge Level (according to Bloom's Taxonomy)
CO1	Estimate blood glucose and blood pressure Acquire Knowledge on Mendelian Genetics	K1
CO2	Apply knowledge of problem solving in interaction of genes	K2
CO3	Perform the basic blood glucose analysis and blood pressure measurements	K2
CO4	Analyze the excretory substances from different samples Experiment with the concepts of multiple alleles. Make use of the knowledge in Biostatistics	K3

K1 - Knowledge K2 - Understand K3 - Apply

Mapping of COs with POs

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

S -Strong M- Medium L- Low

Title of the paper: Genetics And Biostatistics & Physiology Practical

A. Genetics and Biostatistics

1. Problems in Monohybrid cross
2. Problems in Dihybrid cross,
3. Problems in Test cross,
4. Problems in Back cross
5. Problems in Incomplete dominance.
6. Problems in interaction of genes
7. Problems in multiple alleles
8. Problems in sex determination and sex linkage
9. Problems in linkage and three point test cross
10. Problems in cytoplasmic inheritance.
11. Problems in Mean , Median , Mode
12. Problems in Standard Deviation
13. Problems in Chi square Test

TEXT BOOKS:

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

REFERENCE BOOKS:

- Richard .D. Kowles. Solving Problems in Biostatistics. Springer, New York.

B. **Physiology**

1. Estimation of blood sugar
2. Assessment of salivary amylase activity
3. Observation of Haemin crystals.
4. Determination of stomatal index
5. Determination of water potential of potato using falling drop method.
6. Determination of Osmotic potential of cell sap using plasmolysis method
7. Estimation of Blood Urea
8. Determination of blood pressure using Sphygmomanometer
9. Qualitative analysis of urine for albumin, sugar, ketone bodies and bile salts
10. Qualitative analysis excretory products –Ammonia, urea, uric acid
11. Determination of sperm count and its motility.

Reference Manual/s:

Fox, S.I. 1999. Human Physiology. VI edn. Mc Graw-Hill Publications, New Delhi.

Hoar W.S 2004. General and Comparative Physiology. Prentice-Hall of India (P) Ltd.New Delhi

Course contents and practical schedule

Exp. No.	Name of the Experiment	Practical hours	Method
	A. Genetics and Biostatistics		
A1.	Problems in Monohybrid cross	3	Hands on Training.
A2.	Problems in Dihybrid cross	3	Hands on Training.
A3.	Problems in Test cross	2	Hands on Training
A4.	Problems in Back cross	2	Hands on Training.
A5.	Problems in Incomplete dominance	2	Hands on Training.
A6.	Problems in interaction of genes	2	Hands on Training.
A7.	Problems in multiple alleles	3	Hands on Training.
A8.	Problems in sex determination and sex linkage	2	Hands on Training.
A9.	Problems in linkage and three point test cross	2	Hands on Training.
A10.	Problems in cytoplasmic inheritance	2	Demonstration
A11.	Problems in Mean , Median , Mode	3	Demonstration
A12.	Problems in Standard Deviation	2	Demonstration
A13.	Problems in Chi square Test	2	Demonstration
	B.Physiology		
B1.	Estimation of blood sugar	2	Hands on training
B2.	Demonstration of salivary amylase activity	2	Hands on training
B3.	Observation of Haemin crystals.	2	Hands on training
B4.	Determination of stomatal index	2	Hands on training
B5.	Determination of water potential of potato using falling drop method.	2+2	Hands on training
B6.	Determination of Osmotic potential of cell sap using plasmolysis method	2+2	Hands on training
B7.	Estimation of Blood Urea	2+2	Hands on training
B8.	Determination of blood pressure using Sphygmomanometer	2	
B9.	Qualitative analysis of urine for albumin, sugar, ketone bodies and bile salts	2+2	Hands on training
B10.	Qualitative analysis excretory products – Ammonia, urea, uric acid	2	Hands on training
B11.	Determination of sperm count and its motility	2	Hands on training
	Total hours		**60**

Thiagarajar College : Madurai – 625 009
Department of Botany
(For those joined B.Sc. Biotechnology on or after June 2019)
Programme Code -UBT

Course Code	Course Title	Category	L	T	P	Credit
UBT19SE41(A)	**Mushroom Technology**	**SEC1**	**2**	**-**	**-**	**2**

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

Preamble

Make use of the knowledge in mushroom cultivation and learn to occupy oneself during leisure time

Course Outcomes

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

#	Course Outcome	Knowledge Level)
CO1	Acquire basic knowledge on the cultivation of mushrooms.	K1
CO2	Develop suitable skills involved in mushroom cultivation.	K2
CO3	Make use of the knowledge in Spawn running	K2
CO4	Learn to make delicious mushroom recipes	K3

K1 - Knowledge K2 - Understand K3 - Apply

Mapping of COs with POs

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

S -Strong M- Medium L- Low

Blooms taxonomy

	CA		End of Semester
	First	Second	
Knowledge	**40%**	**40%**	**40%**
Understand	**40%**	**40%**	**40%**
Apply	**20%**	**20%**	**20%**
Total Marks	**30**	**30**	**65**

Title of the paper: Mushroom Technology

Unit I

History of mushroom Cultivation – Nutritional value of mushrooms, Morphology of mushrooms – Life cycle of mushrooms – Mushroom Cultivation – Temperature, Moisture, Ventilation, growing space. Compost for mushroom cultivation. Preparation of mother Spawn – Spore Culture and Tissue culture method.

Unit II

Cultivation of Pleurotus sp and *Agaricus* sp. Spawn and methods of spawning – grain spawn , – storage of spawn – casing – cropping and harvesting – Diseases - Preservation – Do's and dont's of mushroom growing - Analysis of nutrients in fruiting body – Economics of mushroom cultivation - Delicious mushroom recipes

Text Books

- Nita Bahl. 1994. Hand Book of Mushroom. 3rd edition. Oxford & IBH Co Ltd, New Delhi.
- Kapoor, J.N.2014. Mushroom cultivation ICAR. New Delhi.
- Banwari George, J. 1998. Basic food microbiology, 2nd Edition. CBS publishers and distributors, New Delhi.

Reference Books:

- Aneja, K.R. 1996. Experiments in Microbiology, Plant pathology. 4th edition. Tissue culture and Mushroom cultivation. Wishwa Prakashan, (New Age International (p) Ltd), New Delhi

Course designer

1.S.Yogachitra 2.S.Siva Durga

Course contents and lecture schedule

Unit	Topic	No of lecture hrs.	Method of teaching
1.1	History of mushroom Cultivation – Nutritional value of mushrooms, Morphology of mushrooms – Life cycle of mushrooms	6	Powerpoint
1.2	Mushroom Cultivation – Temperature, Moisture, Ventilation, growing space	5	Black board
1.3	Compost for mushroom cultivation. Preparation of mother Spawn – Spore Culture and Tissue culture method	5	Black board
2.1	Cultivation of Pleurotus sp and *Agaricus* sp. Spawn and methods of spawning – grain spawn , – storage of spawn – casing – cropping and harvesting – Diseases – Preservation	6	Black board
2.2	Do's and dont's of mushroom growing - Analysis of nutrients in fruiting body	4	Black board
2.3	Economics of mushroom cultivation - Delicious mushroom recipes	4	Powerpoint
	Total hours	30	

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Programme Code -UBT

Course Code	Course Title	Category	L	T	P	Credit
UBT19SE41(B)	Organic Farming	SEC1	2	-	-	2

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

Preamble

To enlighten the students about the significance of organic farming and biofertilizers in sustainable agriculture.

Course Outcomes

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

#	Course Outcome	Knowledge Level
CO1	Rationalize the significance of organic farming	K1
CO2	Evaluate different type of composing methods and their advantages	K2
CO3	Illustrate the production and applications of natural biopesticides and growth promoters.	K2
CO4	Evaluate the utilization of biofertilizers and bioinoculants for sustainable agricultural production.	K3

K1 - Knowledge K2 - Understand K3 - Apply

Mapping of COs with POs

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

S -Strong M- Medium L- Low

Blooms Taxonomy

	CA		End of Semester
	First	Second	
Knowledge	40%	40%	40%
Understand	40%	40%	40%
Apply	20%	20%	20%
Total Marks	30	30	65

Title of the paper: Organic Farming

Unit I: Composting: Types of composting, materials for composting, composting process, , decomposition stages in composting, vermicomposting - Vermiwash, Coir pith composting. Preparation of Panchakavya and its applications.

Unit II: Biofertilizers: Definition – Organisms involved – Bacteria: Rhizobium, Azotobacter, Azospirillum and Phosphobacteria. Isolation, characterization, identification, mass cultivation and inoculation method. Genetics of Nitrogen fixation- *Klebsiella pneumoniae* – Symbiotic bacteria – Rhizobium. Cyanobacterial Biofertilizer: Algalization – mass cultivation of cyanobacterial biofertilizers – mass production of carrier – based, immobilized cyanobacterial inoculants. Azolla – Morphology – Mass cultivation and Application.

Text Books:

- Kannaiyan, S. 2002 Biotechnology of Biofertilizers. Narosa publishing house, New Delhi.
- Dubey, R.C. 2001. A text book of microbiology, second reprint. S. Chand and Company Ltd., New Delhi.

Reference Books

- Ann Larkin Hansen , 2010, The Organic Farming Manual: A Comprehensive Guide to Starting and Running a Certified Organic Farm. Storey Publishing LLC.

Course designed by: Dr. K. Thangavel

Course contents and lecture schedule

Unit	Topic	Lecture hrs.	Teaching Method
1.1	Composting: Types of composting - materials for composting, composting process	3	Power point
1.2	Decomposition stages in composting,	3	Power point
1.3	Vermicomposting methods- Vermiwash, Coir pith composting.	3	Power point
1.4	Preparation of *Panchakavya* and its applications.	3	Power point
2.1	Biofertilizers - Definition – Organisms involved – Bacteria: Rhizobium, Azotobacter, Azospirillum and	3	Black/white board
2.2	Phosphobacteria isolation, characterization, identification, mass cultivation and inoculation method.	3	Black/white board
2.3	Genetics of Nitrogen fixation- Klebsiella pneumoniae – Symbiotic bacteria – Rhizobium.	3	Power point
2.4	Cyanobacterial Biofertilizer: Algalization – mass cultivation of cyanobacterial biofertilizers –	3	Power point
2.5	Mass production of carrier – based, immobilized cyanobacterial inoculants.	3	Black/white board
2.6	Azolla – Morphology – Mass cultivation and Application.	3	Black/white board
	Total hours	**30**	

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Programme Code -UBT

Course Code	Course Title	Category	L	T	P	Credit
UBT19SE41(C)	**Plant Tissue Culture**	**SEC1**	**2**	**-**	**-**	**2**

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

Preamble

Familiar with basic principles and techniques in plant tissue culture.

Course Outcomes

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

#	Course Outcome	Knowledge Level
CO1	Acquire knowledge in basic principles of plant tissue culture.	K1
CO2	Apply the techniques in tissue culture	K2
CO3	Make use of the knowledge in micropropogation.	K2
CO4	Experiment the knowledge in pharmaceutical industry.	K3

K1 - Knowledge K2 - Understand K3 - Apply

Mapping of COs with POs

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

S -Strong M- Medium L- Low

Blooms taxonomy

	CA		End of Semester
	First	Second	
Knowledge	**40%**	**40%**	**40%**
Understand	**40%**	**40%**	**40%**
Apply	**20%**	**20%**	**20%**
Total Marks	**30**	**30**	**65**

Title of the paper: Plant Tissue Culture

Unit I:
History of plant cell and tissue culture, Nutrient media: Composition of commonly used culture media. The concept of totipotency of cells, Role of plant growth hormones in tissue culture, various types of cultures: callus, cell suspension, root, meristem, anther culture, pollen culture.

Unit II:
Micropropagation, Organogenesis - formation of shoots and roots, Somatic embryogenesis - Process of somatic embryogenesis, Synthetic seeds-applications, Applications of tissue culture in forestry, horticulture, agriculture and pharmaceutical industry.

Text books:
- Smith, R. H. 1992. Plant Tissue Culture: Techniques and Experiments, Academic Press, San Diego
- Gupta, P. K. (2000). Elements of Biotechnology, Rastogi Publications, Meerut.
- Dubey, R. C. 2001. A text book of biotechnology, S Chand & Co., New Delhi.
- Kalyankumar De. 2008. Plant tissue culture, New Central Book Agency, Calcutta.

Reference books:
- Bhojwani, S. S. and Razdan, M. K. 2004. Tissue Culture: Theory and Practice, Elsevier, New Delhi.
- Purohit, S. S. 2010. Plant tissue culture, Student edition, S.S. Publication, Jodhpur.
- Smith, R. 2012. Plant Tissue Culture, Techniques and Experiments, Third Edition, Academic Press, Sandiego.
- Bhojwani, S. S. and P.K. Dantu. 2013. Plant Tissue Culture: An Introductory Text, Springer, India.

Course designers:
1. **S.YogachitraS.Siva Durga**

Course contents and lecture schedule

Unit	Topic	lecture hrs.	Method of teaching
1.1	History of plant cell and tissue culture, Nutrient media: Composition of commonly used culture media.	5	Black Board
1.2	The concept of totipotency of cells, Role of plant growth hormones in tissue culture	5	Black Board
1.3	Various types of cultures: callus, cell suspension, root, meristem, anther culture, pollen culture.	5	Black Board
2.1	Micropropagation, Organogenesis - formation of shoots and roots, Somatic embryogenesis - Process of somatic embryogenesis	5	BlackBoard
2.2	Synthetic seeds-applications, Applications of tissue culture in forestry	5	Power Point
2.3	Horticulture, agriculture and pharmaceutical industry.	5	Power Point
	Total Hours	30	

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Programme Code -UBT

Course Code	Course Title	Category	L	T	P	Credit
UBT19C51	**Genetic Engineering**	**Core-7**	**5**	**-**	**-**	**5**

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

Preamble

Learn the recent development in gene technology and appreciate the advancement in genetic engineering

Course Outcomes

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

#	Course Outcome	Knowledge Level
CO1	Apply the principle of Genetic engineering; appreciate the importance of DNA modifying enzymes	K2
CO2	Demonstrate the use of gene cloning vectors	K3
CO3	Criticize the core techniques in gene manipulation.	K1
CO4	Make use of screening and selection procedures.	K3
CO5	Experiment with PCR.	K3

K1 - Knowledge K2 - Understand K3 - Apply

Mapping of COs with POs

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

S -Strong M- Medium L- Low

Blooms taxonomy

	CA		End of Semester
	First	Second	
Knowledge	**40%**	**40%**	**40%**
Understand	**40%**	**40%**	**40%**
Apply	**20%**	**20%**	**20%**
Total Marks	**52**	**52**	**140**

Title of the paper: Genetic Engineering

Unit I

Principles of genetic engineering , Restriction enzymes – nomenclature , classification , types. DNA modifiying enzymes – ligases – alkaline phosphatase – DNA polymerase, Holoenzyme – RNases – reverse transcriptase – Poly(A) polymerase, S1 nuclease, terminal deoxy nucleotide transferase.

Unit II

Gene cloning vectors – plasmids: types – isolation and amplification – bacterial plasmids as cloning vectors. PBR322, pUC18 and Col E1. Bacteriophage vector for *E. coli* – lambda phage as a vector – Lambda replacement and insertion vectors and their uses. Shuttle vectors – expression vectors. Cosmid & Phasmid vectors.

Unit III

Core techniques in gene manipulation: Cloning strategies, sticky and blunt end cloning. Cloning from mRNA – synthesis of cDNA, cloning of cDNA using plasmid and phage vectors – Cloning from genomic DNA. Construction of genomic libraries and cDNA libraries.

Unit IV

Methods of selection and screening of recombinant DNA: α -complementation. Hybridization - colony & plaque. Marker inactivation – insertional inactivation – expression screening techniques, radio-labeling. Blotting techniques: Southern, Northern and Western. Chromosome walking & jumping.

Unit V

Gene amplification: Basic principles and applications of PCR - primer designing and optimization. Types of PCR. DNA foot printing, finger printing, Mapping of human genes – human genome project.

Text Books:

- Primrose, S.B. and R.M. Twyman, 2009. Principles of Genome Analysis and genomics, Blackwell publishing, USA.
- Old R. W and S. B. Primrose. 1996, 5th edition. Principles of gene manipulations, Black well Science Publications, London.
- Sandya Mitra, 1998. Genetic engineering, Mac India ltd., New Delhi.
- Watson, J. D., N. H. Hopkins, J.W. Roberts, J.A. Steitz and A .M . Weiner, 2014. Molecular Biology of the gene, 7th edition, The Benjamin / Cummings Publishing Company Inc., Tokyo.

Reference Books:

- Brown. T. A., 2000. gene cloning, Seventh edition, Chapman and Hall Publication, USA.
- Lewin B., 2008, 11th edition. Genes IX, Oxford University Press, Oxford, U.K.
- Winnaker, E.L., 2003. From Genes to Clone: Introduction to Gene Technology, VCH publications, Weinbeim Fedreral Republic German.

Course designers: S.Siva DurgaS.Yogachitra

Course contents and lecture schedule

Unit	Topic	No of lecture hrs.	Method of Teaching
1.1	Principles of genetic engineering	1	Black board
1.2	Restriction enzymes – nomenclature , classification , types	3	Black board
1.3	DNA modifiying enzymes – ligases – alkaline phosphatase – DNA polymerase	4	Black board
1.4	Holoenzyme – RNases – reverse transcriptase – Poly(A) polymerase	4	Black board
1.5	S1 nuclease, terminal deoxy nucleotide transferase	4	Black board
2.1	Gene cloning vectors – plasmids: types – isolation and amplification – bacterial plasmids as cloning vectors	2	PowerPoint
2.2	PBR322, pUC18 and Col E1	4	Black board
2.3	Bacteriophage vector for *E. coli* – lambda phage as a vector – Lambda replacement and insertion vectors and their uses	4	PowerPoint
2.4	Shuttle vectors – expression vectors. Cosmid & Phasmid vectors.	4	Black board
3.1	Core techniques in gene manipulation: Cloning strategies, sticky and blunt end cloning.	3	Black board
3.2	Cloning from mRNA – synthesis of cDNA, cloning of cDNA using plasmid and phage vectors – Cloning from genomic DNA.	4	Powerpoint
3.3	Construction of genomic libraries and cDNA libraries.	4	Powerpoint
4.1	Methods of selection and screening of recombinant DNA: α –complementation	2	Powerpoint
4.2	Hybridization - colony & plaque. Marker inactivation Insertional inactivation	2	Black board
4.3	Expression screening techniques, radio-labeling.	2	Black board
4.4	Blotting techniques: Southern, Northern and Western	3	Black board
4.5	Chromosome walking & jumping	1	Powerpoint
5.1	Gene amplification: Basic principles and applications of PCR	3	Black board
5.2	Primer designing and optimization. Types of PCR.	4	Black board
5.3	DNA foot printing, finger printing	4	Black board
5.4	Mapping of human genes – human genome project.	2	Powerpoint
	Total Hours	60	

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Course Code	Course Title	Category	L	T	P	Credit
UBT19CL51	**Genetic Engineering Lab**	**Core Lab 5**	**-**	**-**	**3**	**2**

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

PREAMBLE

Acquire knowledge on the extraction of Nucleic Acids, procedures of Gene Manipulation. Have hands on training on electrophoretic procedures and blotting techniques.

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

#	Course Outcome	Knowledge Level (according to Bloom's Taxonomy)
CO1	Acquire knowledge on Restriction digestion and ligation	K1
CO2	Apply the knowledge on the extraction of nucleic acids	K3
CO3	Experiment with electrophoresis procedures	K3
CO4	Understand the mechanisms involved in PCR	K2

K1 - Knowledge K2 - Understand K3 – Apply

Mapping of COs with POs

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

S -Strong M- Medium L- Low

Title of the paper: Genetic Engineering lab

1. Separation of bacterial genomic DNA by Agarose Gel electrophoresis.
2. RNA separation by Agarose gel electrophoresis.
3. Isolation and estimation of Cyanobacterial DNA

4. Isolation of plasmid DNA (pDNA) from bacteria
5. Demonstration of Restriction digestion
6. Demonstration of Ligation process
7. Demonstration of Southern blotting of DNA
8. Demonstration of Northern blotting of RNA
9. Demonstration of PCR
10. Separation of proteins by PAGE
11. Demonstration of Western blotting

TEXT BOOKS:

- Jhon Vennison.S. 2009. Laboratory Manual for Genetic Engineering. Prentice Hall India Learning pvt. Ltd.
- Kumaresan.V. 2014. Techniques in Biotechnology. Saras publications, Tamilnadu.
- Janarthanan.S, Vincent.S. 2007. Practical Biotechnology, Methods and Protocols. Universities Press, England.

REFERENCE BOOKS:

- Jane K. Setlow.2010. Genetic Engineering, Principles and Methods. Springer, NewYork.

Course designers:

1. **S.Siva DurgaS.Yogachitra**

Course contents and lecture schedule

S.No.	Experiment	No of hrs.	Method of teaching
1	Separation of bacterial genomic DNA by Agarose Gel electrophoresis	6	Hands on Training.
2	RNA separation by Agarose gel electrophoresis	6	Hands on Training.
3	Isolation and estimation of Cyanobacterial DNA	6	Hands on Training
4	Isolation of plasmid DNA from bacteria	4	Hands on Training.
5	Demonstration of Restriction digestion	3	Demonstration
6	Demonstration of Ligation process	3	Demonstration
7	Demonstration of Southern blotting of DNA	3	Demonstration
8	Demonstration of Northern blotting of RNA	3	Demonstration
9	Demonstration of PCR	4	Demonstration
10	Separation of proteins by PAGE	4	Hands on Training.
11	Demonstration of Western blotting	3	Demonstration
	Total Hours	45	

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Course Code	Course Title	Category	L	T	P	Credit
UBT19C52	**Industrial Biotechnology**	**CORE 8**	**4**	**-**	**-**	**4**

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

Preamble

Understand the principles and strategies involved in using biological systems for technological applications and Develop an appreciation of the complex strategies involved in a biotechnological process.

Course Outcomes

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

#	Course Outcome	Knowledge Level
CO1	Acquire knowledge on media formulation	K1
CO2	Apply the concept of downstream processing	K3
CO3	Explain the operation & control of bioreactors.	K1
CO4	Apply the processes on a commercial scale	K3
CO5	Analyze the principle of enzyme production, application of enzymes.	K2

K1 - Knowledge K2 - Understand K3 - Apply

Mapping of COs with POs

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

S -Strong M- Medium L- Low

Blooms taxonomy

	CA		End of Semester
	First	Second	
Knowledge	**40%**	**40%**	**40%**
Understand	**40%**	**40%**	**40%**
Apply	**20%**	**20%**	**20%**
Total Marks	**52**	**52**	**140**

Title of the Paper: Industrial Biotechnology

Unit I

Definition and scope of industrial biotechnology. Industrial fermentation: Upstream processes – media formulation – media sterilization – inoculum development – screening of industrially important microbes – Strain improvement – Types of fermentation –batch, fed batch, continuous processes.

Unit II

Downstream processing: Biomass separation methods – centrifugation, precipitation, filtration (membrane filtration, gel filtration and fluid filtration) - cell disruption –product recovery - liquid-liquid extraction, chromatography purification, concentration and crystallization.

Unit III

Fermentors or Bioreactors – Principles of chemostat and turbidostat – designs of Batch, Continuous stirrer type fermentor, Tower, Fluidized bed fermentors – operation and control . Industrial alcohol production – gasohol – fermentation of wine and beer

Unit IV

Amino acid fermentation (L – Glutamic acid and L- Lysine). Fermentation of antibiotics [Penicillin & Streptomycin] – organic acids [Citric acid, Lactic acid,Vinegar & Kojic acid] - Vitamins [Riboflavin & Cyanocobalamine] and steroids.

Unit V

Enzyme biotechnology – Principles – Industrial enzyme production methods: tray and deep bed cultivation– enzyme recovery and purification – methods of enzyme immobilization. Production of α – amylase, protease and cellulase - application of industrial enzymes.

Text Books:

- Casida, L.E. Jr. 2015. Industrial Microbiology. New age International Publishers, New Delhi.
- Patel, A.H. 2016, 2nd edition. Industrial Microbiology. Macmillan India Ltd, Delhi.
- Crueger, W. and A. Crueger. 2002, 2nd edition. Biotechnology: A Textbook of Industrial Microbiology. Panima publishing corporation, New Delhi.
- Reed, G. 1987. Prescott and Dunn‘s Industrial Microbiology. CBS publishers and Distributors, New Delhi.

Reference Books:

- Stanbury, P.F., A. Whitaker. and S.J. Hall. 2009. Principles of Fermentation Technology. Aditya Books (P) Ltd, New Delhi.

Course designers:

1. **S.Yogachitra**
2. **S.Siva Durga**

Course contents and lecture schedule

Unit	Topic	No of lecture	Method of

		hrs.	Teaching
1.1	Definition and scope of industrial biotechnology	2	Blackboard
1.2	Industrial fermentation: Upstream processes – media formulation – media sterilization – inoculum development	3	PowerPoint
1.3	Screening of industrially important microbes – Strain improvement	3	Blackboard
1.4	Types of fermentation –batch, fed batch, continuous processes	4	Blackboard
2.1	Downstream processing: Biomass separation methods – centrifugation, precipitation, filtration (membrane filtration, gel filtration and fluid filtration)	5	Blackboard
2.2	Cell disruption –product recovery - liquid-liquid extraction, chromatography purification, concentration and crystallization.	3	Blackboard
3.1	Fermentors or Bioreactors – Principles of chemostat and turbidostat	5	PowerPoint
3.2	Designs of Batch, Continuous stirrer type fermentor, Tower, Fluidized bed fermentors – operation and control.	3	Blackboard
3.3	Industrial alcohol production – gasohol – fermentation of wine and beer	3	Blackboard
4.1	Amino acid fermentation (L – Glutamic acid and L- Lysine).	4	PowerPoint
4.2	Fermentation of antibiotics [Penicillin & Streptomycin]	4	Blackboard
4.3	Organic acids [Citric acid, Lactic acid,Vinegar & Kojic acid]	4	PowerPoint
4.4	Vitamins [Riboflavin & Cyanocobalamine] and steroids.	4	Blackboard
5.1	Enzyme biotechnology – Principles – Industrial enzyme production methods: tray and deep bed cultivation	4	PowerPoint
5.2	enzyme recovery and purification – methods of enzyme immobilization	5	Blackboard
5.3	Production of α – amylase, protease and cellulase - application of industrial enzymes.	4	PowerPoint
	Total Hours	60	

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Course Code	Course Title	Category	L	T	P	Credit
UBT19L52	**Industrial Biotechnology Lab**	**Core Lab 6**	**-**	**-**	**4**	**2**

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

Preamble

Acquire knowledge on the various aspects of Bioprocesses technology and strain improvement. Have hands on training on the fermentation procedures and downstreaming procedures.

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

#	Course Outcome	Knowledge Level (according to Bloom's Taxonomy)
CO1	Acquire knowledge on Strain improvement techniques	K1
CO2	Apply the knowledge on the immobilization procedures	K3
CO3	Experiment with fermentation of alcohol	K3
CO4	Understand the mechanisms involved in enzyme production	K2

K1 - Knowledge K2 - Understand K3 – Apply

Mapping of COs with POs

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

S -Strong M- Medium L- Low

Title of the paper: Industrial Biotechnology lab

1. Giant colony technique for antibiotic producing organisms.
2. Isolation of antibiotic producing organism
3. Isolation of cellulolytic organisms from soil
4. Mutant strains by UV irradiation

5. Immobilization of cells in calcium alginate beads
6. Alcohol fermentation by yeast and quantification of ethanol.
7. Citric acid production by *Aspergillus niger*

8. Extracellular enzyme fungal amylase.
9. Demonstration of wine production
10. Production of lovastatin by solid state fermentation

TEXT BOOKS:

- Chellapandi P. 2007. Laboratory manual in Industrial Biotechnology. Pointers publishers, Jaipur.
- Richard H.,Julian D. Davies. 2010. Manual of Industrial Microbiology and Biotechnology. Third Edition. ASM press, Washington D.C.

REFERENCE BOOKS:

- William M. Fogarty, Catherine T. Kelly.2011.Microbial Enzymes and Biotechnology. Second edition. Springer, United Kingdom.
- Jose Luis Barredo.2010. Microbial Enzymes and Biotransformations. Humana press, NewYork.

Course designers:

1. **S.Yogachitra**
2. **S.Siva Durga**

Course contents and lecture schedule

S.No.	Experiment	No of lecture hrs.	Method of teaching
1	Giant colony technique for antibiotic producing organisms	7	Hands on Training.
2	Isolation of antibiotic producing organism	7	Hands on Training.
3	Isolation of cellulolytic organisms from soil	10	Hands on Training
4	Mutant strains by UV irradiation	7	Hands on Training.
5	Immobilization of cells in calcium alginate beads	3	Demonstration
6	Alcohol fermentation by yeast and quantification of ethanol.	7	Demonstration
7	Citric acid production by *Aspergillus niger*	7	Demonstration
8	Extracellular enzyme fungal amylase.	4	Demonstration
9	Demonstration of wine production	4	Demonstration
10	Production of lovastatin by solid statefermentation	4	Hands on Training.
	Total Hours	60	

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Course Code	Course Title	Category	L	T	P	Credit
UBT19C53	Marine Biotechnology	Core 9	4	-	-2	5

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

Preamble

To enlighten the students about the vast ecology of the oceanic habitat and its contribution to the marine biotechnology studies.

Course Outcomes

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

#	Course Outcome	Knowledge Level (according to Bloom's Taxonomy)
CO1	Understand the ecological importance of oceanic habitat	K2
CO2	Analyze the impact of pollutants in the marine ecosystem.	K2
CO3	Appreciate and admire artistic beauty of marine seaweeds.	K1
CO4	Make use of marine seaweeds commercially.	K3
CO5	Experiment with Marine biotechnology in the wider biological sense.	K3

K1 - Knowledge K2 - Understand K3 - Apply

Mapping of COs with POs

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

S -Strong M- Medium L- Low

Blooms taxonomy

	CA		End of Semester
	First	Second	
Knowledge	40%	40%	40%
Understand	40%	40%	40%
Apply	20%	20%	20%
Total Marks	52	52	140

Title of the paper: Marine Biotechnology

Unit I

Different strata of Oceanic habitat- Physical, chemical and biological aspects and their interaction with marine life- Marine flora: Phytoplankton, Benthos, Seaweeds and Sea grasses - Distribution pattern of sea weed resources in Indian Seas.

Unit II

Marine Pollution: Major pollutant – Biodegradation of waste materials by sea weeds. Biological indicators: Marine microbes and Algae. Monitoring of heavy metal pollution using phytoplankton and seaweeds – Algal bloom – Red tide – Toxic Dinoflagellates – exo and endo toxins – Bioluminescence.

Unit III

Warm water Mariculture: Seaweed farming in India, Japan and Thailand – Methods of seaweed cultivation : Lagoon culture, Coir rope culture, Net' cultivation method, Seaweed culture by spores method . Indoor & Outdoor mass cultivation & harvesting strategies of marine species of *Spirulina subsalsa.*

Unit IV

Commercial exploitation of Micro & Macro algae: Sources, chemistry and extraction of Phycocolloids: Alginates, Agar-agar and Carrageenan. Seaweed manure and Seaweed liquid fertilizers for agriculture.

Unit V

Utilization of Micro & Macro algae : Major uses of *Porphyra*, *Gracilaria*, *Undaria*, *Laminaria*, *Hypnea* and *Ulva* - Edible seaweeds. Neutraceuticals: Micro algal products – Pigments, Anti-oxidant, Omega-3 Fatty acids and Immune system stimulant. Fodder: Seaweed meal for Pisiculture, Poultry feed and other farm animals .Uses of Diatomite.

Text Books:

- Austin.1992. Marine Microbiology. Cambridge press. London
- Raymont.J. 1963. Plankton and productivity in the Ocean, Pergamon press. London
- Venkataraman,G.S. 1974. Algae: Form and Function. Todays & Tomorrow's publishers, New Delhi.
- Imai, LT. 1982. Progress in shallow sea culture techniques of seaweed culture. Tokyo: Koseisha Koseika publishers (English translation
- Sundaralingam,V. 1991. Marine Algae, Bishan Singh and Mahendra Pal Singh Publishers, Dehradun.

Reference Books:

- Venkataraman,L.V.2002.Application of algal Biotechnology in the next millennium. In: A.Anand (ed.) Algal research in India. Dehradun.India.

- Subramanian G. 1998. Marine Cyanobacteria for feed, fine chemicals & Pharmaceuticals. Cyanobacterial Biotechnology.Oxford IBH Co.pvt.Ltd., New Delhi. ISBN 81-2041269-9.
- Subba Rangaiah, G. 1999. Recent trends in Algal Research. Publisher-Marine Algal Laboratory. Visakapatanam.A.P.
- Krishnamurthy,V. 2000. Algae of India and neighbouring countries. Oxford & IBM Publ

Course Designer:G. Ramya vaideki

Course contents and lecture schedule

Unit	Topic	Lecture hrs.	Method
1.1	Different strata of Oceanic habitat- Physical, chemical and biological aspects and their interaction with marine life-	2	Black board
1.2	Marine flora: Phytoplankton, Benthos, Seaweeds and Sea grasses	4	PowerPoint
1.3	Distribution pattern of sea weed resources in Indian Seas	4	PowerPoint
2.1	Marine Pollution: Major pollutant – Biodegradation of waste materials by sea weeds	5	Black board
2.2	Biological indicators: Marine microbes and Algae	2	PowerPoint
2.3	Monitoring of heavy metal pollution using phytoplankton and seaweeds Algal bloom – Red tide –	4	Black board
2.4	Toxic Dinoflagellates – exo and endo toxins – Bioluminescence	2	Black board
3.1	Warm water Mariculture: Seaweed farming in India, Japan and Thailand	4	PowerPoint
3.2	Methods of seaweed cultivation : Lagoon culture, Coir rope culture,	4	PowerPoint
3.3	Net‘ cultivation method, Seaweed culture by spores method	3	PowerPoint
3.4	..Indoor & Outdoor mass cultivation & harvesting strategies of marine species of *Spirulina subsalsa*	4	PowerPoint
4.1	Commercial exploitation of Micro & Macro algae: Sources, chemistry	5	PowerPoint
4.2	extraction of Phycocolloids: Alginates, Agar-agar and Carrageenan. Seaweed manure and Seaweed liquid fertilizers for agriculture	5	PowerPoint
5.1	Utilization of Micro & Macro algae : Major uses of *Porphyra*, *Gracilaria*, *Undaria*, *Laminaria*, *Hypnea* and *Ulva* - Edible seaweeds.	4	PowerPoint
5.2	Neutraceuticals : Micro algal products – Pigments, Anti-oxidant, Omega-3 Fatty acids and Immune system stimulant.	4	Black board
5.3	Fodder: Seaweed meal for Pisiculture, Poultry feed and other farm animals .Uses of Diatomite.	4	Black board

Thiagarajar College : Madurai – 625 009
Department of Botany
(For those joined B.Sc. Biotechnology on or after June 2019)
Programme Code -UBT

Course Code	Course Title	Category	L	T	P	Credit
UBT19CL53	**Marine Biotechnology lab**	**Core lab 7**	**-**	**-**	**2**	**1**

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

Preamble

To provide the students with the basic practical knowledge on extraction of products from marine forms and its application.

Course Outcomes

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

#	Course Outcome	Knowledge Level (according to Bloom's Taxonomy)
CO1	Examine the structural organization and diversity of seaweeds	K1
CO2	Prepare commercial products from marine algae	K2
CO3	Prepare of sea weed liquid fertilizers (SLF) from seaweeds	K2
CO4	Use marine algae to treat effluents	K3

K1 - Knowledge K2 - Understand K3 - Apply

Mapping of COs with POs

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

S -Strong M- Medium L- Low

Title of the paper: Marine Biotechnology Lab

1. Study of external morphology and micro preparations of the marine seaweeds: Ulva, Caulerpa, Sargassum, Turbinaria, Padina and Gracilaria

2. Laboratory cultivation of marine cyanobacteria.
3. Extraction and processing of agar agar and carrageenan from red seaweeds.
4. Extraction and processing of alginates from marine kelp.

5. Extraction of chlorophylls and carotenoids from macroscopic marine green algae
6. Bioremediation of oil spilled effluent using marine cyanobacteria.
7. Biosorption of heavy metal from ore effluent using seaweeds and cyanobacteria.
8. Preparation of sea weed liquid fertilizers (SLF) from brown and red seaweeds.
9. Effect of SLF of on seed germination.

Reference Manual/s:

Austin.1992. Marine Microbiology. Cambridge press. London

Raymont.J. 1963. Plankton and productivity in the Ocean, Pergamon press. London

Venkataraman,G.S. 1974. Algae: Form and Function. Todays & Tomorrow's publishers, New Delhi.

Course Designer: G. Ramya vaideki

Course contents and practical schedule

Exp. No.	Name of the Experiment	Practical hours	Teaching Method
1.	Study of external morphology and micro preparations of the marine seaweeds: Ulva, Caulerpa, Sargassum, Turbinaria, Padina and Gracilaria	2+2	Hands on training
2.	Laboratory cultivation of marine cyanobacteria	2	Hands on training
3.	Extraction and processing of agar agar and carrageenan from red seaweeds	2	Hands on training
4.	Extraction and processing of alginates from marine kelp	2+2	Hands on training
5.	Extraction of chlorophylls and carotenoids from macroscopic marine green algae	2	Hands on training
6.	Bioremediation of oil spilled effluent using marine cyanobacteria	2+2	Hands on training
7.	Biosorption of heavy metal from ore effluent using seaweeds and cyanobacteria	2+2	Hands on training
8.	Preparation of sea weed liquid fertilizers (SLF) from brown and red seaweeds.	2+2	Hands on training
9.	Effect of SLF of on seed germination.	2+2	Hands on training
Total hours			30

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Programme Code -UBT

Course Code	Course Title	Category	L	T	P	Credit
UBT19CE51(A)	**Applied Microbiology**	**Core elective**	**4**	**-**	**-**	**5**

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

Preamble

Enables the students to understand the industrial importance and application of microorganisms

Course Outcomes

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

#	Course Outcome	Knowledge Level (Bloom's axonomy)
CO1	Gain an understanding of the role of microorganisms in food, agro and environmental microbiology.	K2
CO2	Understand the conceptual applications of microbes in various fields.	K2
CO3	Grab a basic idea about the fermenter and fermented products.	K3
CO4	Analyse the biochemical role of microorganisms in different industries	K1
CO5	Depict the industrially important microorganisms used for fermentation.	K2

K1 - Knowledge K2 - Understand K3 - Apply

Mapping of COs with POs

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

S -Strong M- Medium L- Low

Blooms taxonomy

	CA		End of Semester
	First	**Second**	
Knowledge	**40%**	**40%**	**40%**
Understand	**40%**	**40%**	**40%**
Apply	**20%**	**20%**	**20%**
Total Marks	**52**	**52**	**140**

Title of the paper: Applied Microbiology

UNIT - I

Physical and chemical characteristics of soil. Rhizosphere and phyllosphere .Plant growth-promoting microorganisms -mycorrhizae, rhizobia, *Azospirillum,Azotobacter,* cyanobacteria, *Frankia* and phosphate-solubilizing microorganisms.Outlines of biological nitrogen fixation (symbiotic, non-symbiotic). Symptoms of plant diseases caused by fungi, bacteria, and viruses

Biological control of plant diseases. Biopesticides – *Bacillus thuringiensis,* Nuclear polyhedrosis virus (NPV), *Trichoderma*.

UNIT-II

Microorganisms of environment (soil, water and air). Role of microorganisms in nutrient cycling (carbon, nitrogen, sulphur). Microbial interactions – mutualism, commensalism, antagonism, competition, parasitism, predation. Microbiology of potable and polluted waters. *E. coli* and *Streptococcus faecalis* as indicators of water pollution. Sanitation of potable water. Sewage treatment (primary, secondary and tertiary). Outlines of biodegradation of environmental pollutants – pesticides.

UNIT III

Microorganisms of food spoilage and their sources. Food intoxication (botulism and staph poisioning), foodborne diseases (salmonellosis and shigellosis) and their detection. Microbiological production of fermented foods – bread, cheese, yogurt. Biochemical activities of microbes in milk. Microorganisms as food – SCP, edible mushrooms (white button, oyster and paddy straw). Concept of probiotics

UNIT IV

Microorganisms of industrial importance – yeasts, moulds, bacteria, actinomycetes. Screening and isolation of industrially-important microorganisms. Outlines of strain improvement.

Types of fermentation – aerobic, anaerobic, batch, continuous, submerged, surface, solid state.

UNIT V

Design of a stirred tank reactor fermentor. Fermentation media. Industrial production of alcohols (ethyl alcohol), beverages (beer), enzymes (amylases), antibiotics (penicillin), amino acids (glutamic acid), organic acids (citric acid), vitamins (B12), biofuels (biogas - methane).

Text books

- Stanbury, P.F., Whitaker, A. and Hall, S.J. (1997). Principles of Fermentation Technology, Aditya Books (P) Ltd. New Delhi.
- Jay, J.M. (1996). Modern Food Microbiology, Chapman and Hall, New York.
- Rangaswami, G. and Bhagyaraj, D.J. (2001). Agricultural Microbiology, 2nd Edition, Prentice Hall of India, New Delhi.
- Subba Rao, N.S. (1999). Soil Microorganisms and Plant Growth. Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi.
- Reddy, S.R. and Singara Charya, M.A. (2007). A Text Book of Microbiology – Applied Microbiology. Himalaya Publishing House, MUBTai
- Singh, R.P. (2007). Applied Microbiology. Kalyani Publishers, New Delhi.

Reference books

- Doyle, M.P., Beuchat, L.R. and Montville, T.J. (1997). Food Microbiology: Fundamentals and Frontiers. ASM Press, Washington D.C., USA.
- Frazier, W.C. and Westhoff, D.C. (1988). Food Microbiology, Mc Graw-Hill, New York

Course Designer:
G. Ramya vaideki

Course contents and lecture schedule

Unit	Topic	No of lecture hrs.	Teaching Method
1.1	Physical and chemical characteristics of soil. Rhizosphere and phyllosphere .	2	Black board
1.2	Plant growth-promoting microorganisms - mycorrhizae, rhizobia, *Azospirillum*,*Azotobacter*, cyanobacteria, *Frankia* and phosphate-solubilizing microorganisms.	4	Black board
1.3	Outlines of biological nitrogen fixation (symbiotic, non-symbiotic). Symptoms of plant diseases caused by fungi, bacteria, and viruses. Biological control of plant diseases.	4	PowerPoint
1.4	Biopesticides – *Bacillus thuringiensis*, Nuclear polyhedrosis virus (NPV), *Trichoderma*.	5	PowerPoint
2.1	Microorganisms of environment (soil, water and air). Role of microorganisms in nutrient cycling (carbon, nitrogen, sulphur). Microbial interactions – mutualism, commensalism,	2	Black board

	antagonism, competition, parasitism, predation.		
2.2	Microbiology of potable and polluted waters. *E. coli* and *Streptococcus faecalis* as indicators of water pollution. Sanitation of potable water. Sewage treatment (primary, secondary and tertiary).	4	PowerPoint
2.3	Outlines of biodegradation of environmental pollutants – pesticides Microorganisms of food spoilage and their sources.	2	Black board
3.1	Food intoxication (botulism and staph poisioning) foodborne diseases (salmonellosis and shigellosis) and their detection. .	4	Black board
3.2	Microbiological production of fermented foods – bread, cheese, yogurt. Biochemical activities of microbes in milk	4	PowerPoint
3.3	Microorganisms as food – SCP, edible mushrooms (white button, oyster and paddy straw). Concept of probiotics..	3	PowerPoint
4.1	Microorganisms of industrial importance – yeasts, moulds, bacteria, actinomycetes.	4	Black board
4.2	Screening and isolation of industrially-important microorganisms Outlines of strain improvement.	5	Black board
4.3	Types of fermentation – aerobic, anaerobic, batch, continuous, submerged, surface, solid state.	5	PowerPoint
5.1	Design of a stirred tank reactor fermentor. Fermentation media.	4	PowerPoint
5.2	Industrial production of alcohols (ethyl alcohol), beverages (beer), enzymes (amylases), antibiotics (penicillin), amino acids (glutamic acid), organic acids (citric acid), vitamins (B12), biofuels (biogas - methane).	6	PowerPoint
		Total hours	75

Thiagarajar College : Madurai – 625 009
Department of Botany
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Programme Code -UBT

Course Code	Course Title	Category	L	T	P	Credit
UBT19CE51(B)	Metabolic Pathways	Core Elective	4	-	-	5

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

Preamble

Understand the types of metabolic pathways and the role of common intermediate compounds. Learn the biosynthesis and breakdown of biomolecules.

Course Outcomes

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

#	Course Outcome	Knowledge Level
CO1	Acquire knowledge about bioenergetics	K1
CO2	Analyze the metabolism of carbohydrates	K2
CO3	Understand the significance of lipid pathways	K2
CO4	Learn protein biosynthesis and degradation	K3
CO5	Make use of knowledge on metabolism of nucleic acids	K3

K1 - Knowledge K2 - Understand K3 - Apply

Mapping of COs with POs

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

S -Strong M- Medium L- Low

Blooms taxonomy

	CA		End of Semester
	First	Second	
Knowledge	40%	40%	40%
Understand	40%	40%	40%
Apply	20%	20%	20%
Total Marks	52	52	140

Title of the paper : Metabolic Pathways

Unit I

Introduction –Types of metabolic pathways: Catabolic, anabolic, cyclic, anapluerotic, amphibolic Pathways- intermediate metabolism. Bioenergetics: Laws of thermodynamics – First and Second Law ,Redox reactions- Redox potential-coupled reactions, High energy compounds: Standard free energy-ATP biosynthesis

Unit II

Metabolism of carbohydrates:Glucose- Glycolysis - Gluconeogenesis, Glycogen metabolism-Glycogenesis- glycogenolysis, Pentose phosphate pathway, Pyruvate oxidation and Citric Acid cycle. Interrelationship between pathways of glucose metabolism.

Unit III

Metabolism of Lipids; Biosynthesis- Fatty acid – Triacyl glycerols –Cholesterol. Oxidation of Saturated acids fatty acids and unsaturated fatty acid: β oxidation, α oxidation.

Unit IV

Biosynthesis of Aminoacid (Overview) – Protein degradation, oxidative deamination – Urea cycle – transmination.

Unit V

Metabolism of nucleic acids . Purine – Biosynthesis – Catabolism, Pyrimidine – Biosynthesis - Degradation, salvage and denovo pathway of nucleic acids.

Text Book:

- Lehninger, A.L. 2012. Biochemistry 6^{th} edition, Kalyani Publishers, Ludhiana.
- Zubay, G.L., Pason, W.W. and Vanee, D.E. 1995. Principles of Biochemistry W.W.C Brown Publishers , Oxford.

Reference Books:

- Stryer, L. 1995. Biochemistry, 5^{th} edition. W.H. Free Man & Company New York.
- Voet , D. and Voet, J.D. 1990, 4^{th} edition. Biochemistry. John Wily & Sons, New York

Course designers:

1. **S.Siva Durga**
2. **S.Yogachitra**

Course contents and lecture schedule

Unit	Topic	No of lecture hrs.	Method of Teaching
1.1	Introduction –Types of metabolic pathways: Catabolic, anabolic, cyclic, anapluerotic, amphibolic Pathways,	3	Power point
1.2	Bioenergetics: Laws of thermodynamics – First and Second Law	3	Blackboard
1.3	Redox reactions- Redox potential-coupled reactions	4	Blackboard
1.4	High energy compounds: Standard free energy	3	Blackboard
1.5	ATP biosynthesis	2	Power point
2.1	Metabolism of carbohydrates: Glucose- Glycolysis – Gluconeogenesis	4	Power point
2.2	Glycogen metabolism- Glycogenesis-glycogenolysis,	4	Power point
2.3	Pentose phosphate pathway,	2	Power point
2.4	Pyruvate oxidation and Citric Acid cycle.	3	Power point
2.5	Interrelationship between pathways of glucose metabolism.	2	Power point
3.1	Metabolism of Lipids; Biosynthesis- Fatty acid – Triacyl glycerols Cholesterol.	3	Blackboard
3.2	Cholesterol biosynthesis	3	Blackboard
3.3	Oxidation of Saturated acids fatty acids and unsaturated fatty acid: β oxidation.	3	Blackboard
3.4	α oxidation	2	Blackboard
4.1	Biosynthesis of Aminoacid (Overview)	3	Power point
4.2	Protein degradation	2	Blackboard
4.3	Oxidative deamination– transmination.	2	Blackboard
4.4	Urea cycle	2	Power point
5.1	Metabolism of nucleic acids	1	Blackboard
5.2	Purine – Biosynthesis – Catabolism	3	Power point
5.3	Pyrimidine – Biosynthesis - Degradation,	3	Power point
5.4	salvage and denovo pathway of nucleic acids.	3	Power point
	Total Hours	60	

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Programme Code -UBT

Course Code	Course Title	Category	L	T	P	Credit
UBT19CE51(C)	**Infectious Diseases**	**Major elective**	**4**	**-**	**-**	**5**

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

Preamble

Depict a concise idea about the symptoms, epidemiology, diagnosis, prevention and control measures of the human, animal and plant diseases.

Course Outcomes

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

#	Course Outcome	Knowledge Level (Bloom's Taxonomy)
CO1	Have an awareness about the human, animal and plant diseases	K1
CO2	Overall idea about the symptoms, epidemiology and diagnosis of the diseases	K2
CO3	Instigate prevention and control measures for the diseases.	K3
CO4	Contemplate the works based on the diseases	K2
CO5	Grab an idea about futuristic approaches in prevention of diseases	K3

K1 - Knowledge K2 - Understand K3 - Apply

Mapping of COs with POs

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

S -Strong M- Medium L- Low

Blooms taxonomy

	CA		End of Semester
	First	Second	
Knowledge	**40%**	**40%**	**40%**
Understand	**40%**	**40%**	**40%**
Apply	**20%**	**20%**	**20%**
Total Marks	**52**	**52**	**140**

Title of the paper: Infectious Diseases

UNIT – I

Symptoms, Epidemiology, Diagnosis, Prevention and Control of the following Human diseases:- Flu, Rabies, AIDS. Tuberculosis, Leprosy and Meningitis.

UNIT – II

Symptoms, Epidemiology, Diagnosis, Prevention and Control of the following Animal diseases:- Anthrax, Black water, Scrapie, Rinder pest, Foot and Mouth, Blue tongue.

UNIT – III

Plant diseases:- Entry of the plant Pathogen, Establishment of Plant pathogens (Enzymes and Toxins). Interaction between host and pathogen (Physical and Biochemical defense)

UNIT – IV

Control methods of plant diseases:- Cultural methods , Quarantine method , Biocontrol method, Chemical methods (Insecticides & Fungicides) – Disease resistant Transgenic Plants.

UNIT – V

Study of the following Plant diseases: Causal organism, Symptoms, Disease cycle and Control. Wheat rust, Cotton blight, Bhendi yellow vein mosaic, Brinjal little leaf, Root knot disease of Tomato and Red rust of Tea.

Text Books:

Mehrotra , R .S 1980 Plant pathology . Tata Mc Grew Hill Publishing Company Ltd., ND.

Pandey, B. P. 1997. Plant pathology. S. Chand & Company, New Delhi.

Arora . R. 1998 Microbiology and diseases. Anmol Publications, New Delhi.

Sharma , P. D 2004 . Plant pathology. Rastogi publications, Meerut.

Ananthanarayan . R and C. K. J. Paniker. 2000 Text book of Microbiology. Orient longman Publishing Company, Hyderabad.

Reference Books :

Schaechter, M., N.C. Englberg., B. I. Eisenstein and G. Medoff . 1999. Mechanisms of Microbial diseases, 3rd edition. Lippincott Williams and Wilkins. Philadelphia

Course Designer: S. Siva Durga

Course contents and lecture schedule

Unit	Topic	No of lecture hrs.	Method
1.1	Symptoms, Epidemiology, Diagnosis, Prevention and Control of the following Human diseases: Flu, Rabies, AIDS.	6	PowerPoint
1.2	Tuberculosis, Leprosy and Meningitis.	6	PowerPoint
2.1	Symptoms, Epidemiology, Diagnosis, Prevention and Control of the following Animal	6	PowerPoint

	diseases:- Anthrax, Black water, Scrapie		
2.2	Rinder pest, Foot and Mouth, Blue tongue.	6	PowerPoint
3.1	Plant diseases:- Entry of the plant Pathogen, Establishment of Plant pathogens (Enzymes and Toxins).	6	Black board
3.2	Interaction between host and pathogen (Physical and Biochemical defense)	4	Black board
4.1	Control methods of plant diseases:- Cultural methods , Quarantine method , Biocontrol method	6	Black board
4.2	Chemical methods (Insecticides & Fungicides) – Disease resistant Transgenic Plants	5	Black board
5.1	Study of the following Plant diseases: Causal organism, Symptoms, Disease cycle and Control Wheat rust, Cotton blight,	5	PowerPoint
5.2	Bhendi yellow vein mosaic, Brinjal little leaf,	5	PowerPoint
5.3	Root knot disease of Tomato and Red rust of Tea.	5	PowerPoint
		Total hours	75

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Programme Code -UBT

Course Code	Course Title	Category	L	T	P	Credit
UBT19C61	**Plant Biotechnology**	**Core-10**	**5**	**-**	**-**	**5**

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

Preamble

To equip the students with the basic principles of plant cell, tissue and organ culture, updated methodologies, techniques and applied aspects of plant genetic engineering.

Course Outcomes

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

#	Course Outcome	Knowledge Level
CO1	Evaluate the basic principles and applications of plant cell, tissue and organ culture	K1
CO2	Appraise different modes of gene transfer in plants	K2
CO3	Demonstrate the production of biotic and abiotic stress resistant transgenic plants	K2
CO4	Depict the production of useful healthcare products through biopharming	K3
CO5	Prepare to address environmental, biosafety and socio-ethical issues on transgenic plants.	K3

K1 - Knowledge K2 - Understand K3 - Apply

Mapping of COs with POs

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

S -Strong M- Medium L- Low

Blooms Taxonomy

	CA		End of Semester
	First	Second	
Knowledge	**40%**	**40%**	**40%**
Understand	**40%**	**40%**	**40%**
Apply	**20%**	**20%**	**20%**
Total Marks	**52**	**52**	**140**

Title of the paper: Plant Biotechnology

Unit I. Plant tissue culture: Introduction to *in vitro* methods – use of growth regulators –Callus culture – organogenesis - Somatic embryogenesis –encapsulated seeds and applications. Micropropagation: apical and axillary bud culture - meristem culture. Protoplasts: isolation and culturing of protoplast-Somatic hybridization.

Unit II. Gene transfer in plants - Agrobacterium mediated gene transfer — Ti Plasmid –Ri Plasmid Vectors- cointegrate vectors – shuttle vector. Virus mediated gene transfer – plant virus as vectors – Gemini viral vectors – CaMV Vectors.

Unit III. Vector less gene transfer - Microinjection, Electroporation and Biolistics. Marker genes for plant transformation – antibiotic – antimetabolite – herbicide resistance markers. Reporter genes- Transgene stability, Expression and gene silencing.

Unit IV. Transgenic plants – resistance to biotic stresses – pest resistance – Bt crops – viral resistance – resistance against fungal and bacterial diseases – Resistance to abiotic stress – herbicides – drought resistance – Improving crop yield - cytoplasmic male sterility – delayed fruit ripening – flavr savr tomato – golden rice.

Unit V. Bio-pharming – plant as bioreactors- Plantibodies – Plantigens - edible vaccines, interferon production in plants. Transgenic plant as bioreactors. Future prospects for GM.

<u>Text Books</u>:

1.Slater, A., N.W. Scott and M.R.Fowler. 2009. Plant Biotechnology: the genetic manipulation of plants, Oxford University Press, US.

2. Old, R. W. and S. B. Primrose. 2000. Principles of gene manipulation. An introduction to genetic engineering, 5th edition. Blackwell Science Ltd., Oxford.

3.Winnacker, E. N. 2003. From genes to clones. Panama publishing corporation Pvt., Ltd., New Delhi.

<u>Reference Books</u>:

1.Chawla, H.S. 2004 Introduction to Plant Biotechnology, 2nd edition. Oxford publishing Co. Pvt Ltd, New Delhi.

2.Bhojwani, Razdan and M. K. Razdan. 1994. Plant Tissue culture. Elsevier North Holland.

3. Ignacimuthu, S.J., 1997. Plant Biotechnology, Oxford and IBH Publishing Company, New Delhi.

Course Designed by:

Dr. K. Thangavel

Course contents and lecture schedule

Unit	Topic	Lecture hrs.	Method
1.1	Plant tissue culture: Introduction to *in vitro* methods – use of growth regulators	3	Black board
1.2	Callus culture – organogenesis - Somatic embryogenesis –.	4	Power point
1.3	encapsulated seeds and applications	2	Power point
1.4	Micropropagation: apical and axillary bud culture - meristem culture.	4	Power point
1.5	Protoplasts: isolation and culturing of protoplast Somatic hybridization.	4	Power point
1.6	Somatic hybridization.	2	
2.1	Gene transfer in plants - Agrobacterium mediated gene transfer	3	Power point
2.2	Ti Plasmid –Ri Plasmid Vectors	4	Power point
2.3	Cointegrate vectors – shuttle vector.	4	
2.4	Virus mediated gene transfer – plant virus as vectors – Gemini viral vectors –	4	Power point
2.5	CaMV Vectors	2	Power point
3.1	Vector less gene transfer - Microinjection, Electroporation and Biolistics.	4	Black board
3.2	Marker genes for plant transformation – antibiotic – antimetabolite – herbicide resistance markers.	3	Black board
3.3	Reporter genes- Transgene stability, Expression and gene silencing.	4	Black board
4.1	Transgenic plants – resistance to biotic stresses – pest resistance – Bt crops – viral resistance – resistance against fungal and bacterial diseases	4	Black board
4.2	Resistance to abiotic stress – herbicides – drought resistance – Improving crop yield -	4	Black board
4.3	Cytoplasmic male sterility – delayed fruit ripening – flavr savr tomato.	4	Power point
4.4	Golden rice.	2	Power point
5.1	Bio-pharming – plant as bioreactors- Plsantibodies	4	Black board
5.2	Plantigens - edible vaccines, interferon production in plants.	3	Black board
5.3	Transgenic plant as bioreactors.	3	Power point
5.4	Future prospects for GM.	4	Power point
Total hours		**75**	

Thiagarajar College : Madurai – 625 009
Department of Botany
(For those joined B.Sc. Biotechnology on or after June 2019)
Programme Code -UBT

Course Code	Course Title	Category	L	T	P	Credit
UBT19CL61	**Plant Biotechnology Practical**	**Core Lab-8**	**-**	**-**	**3**	**2**

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

Preamble

To provide the students with the hands on experimental exposure on basic plant cell, tissue and organ culture and plant microbe interactions.

Course Outcomes

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

#	Course Outcome	Knowledge Level
CO1	Prepare plant tissue culture medium and initiate different organ cultures in vitro.	K1
CO2	Evaluate the applications of different PGRs in plant cell tissue and organ culture.	K2
CO3	Demonstrate the methods of acclimation and production of useful phytochemicals through cell and organ cultures *in vitro*.	K2
CO4	Depict the plant microbe interaction with reference to symbiotic nitrogen fixation.	K3

K1 - Knowledge K2 - Understand K3 - Apply

Mapping of COs with POs

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

S -Strong M- Medium L- Low

Title of the paper: Plant Biotechnology Practical

1. Preparation of tissue culture medium (MS medium).
2. Preparation and surface sterilization of explant.
3. Callus induction from the leaf explants of Datura/any other plant.
4. Shoot initiation from callus.
5. Root initiation from *in vitro* formed shoots.
6. Hardening and transplantation (Demonstration).

7. Isolation of nitrogen fixing Rhizobium, Azotobacter, Azospirillum and Phosphate solubilizing bacteria from soil.
8. Isolation of protoplast from mesophyl tissue.
9. Determining the viability of protoplast.
10. Preparation of synthetic seeds.

Reference Manual/s:

Dodds, J. H. and L. W. Roberts. 1982. Experiments in Plant Tissue Culture. 3rd edition. Cambridge University Press, Cambridge.

Dodds. J. H. 1991. *In vitro* Methods of Conservation of Plant Genetic Resources. Chapman and Hall, London.

Krishnamoorthy, K. V. 1988. Methods in Plant Histochemistry. Viswanathan publishers, Chennai, India.

Thorpe, T. A. 1993. *In vitro* organogenesis and somatic embryogenesis: physiological and biochemical aspects. In: Roubelakis-Angelakis KA, Tran Tranh Van T (Eds.). Morphogenesis in Plants. Plenum Publishing Corp., New York.

Vasil, I. K. and T. A. Thorpe. 1994. Plant Cell and Tissue Culture. Kluwer Academic Publishers. Dordrecht.

Course Designed by:
Dr. K. Thangavel
Course contents and practical schedule

Exp. No.	**Name of the Experiment**	**Practical hours**	**Teaching Method**
1.	Preparation of plant tissue culture medium (MS medium).	3+3	Hands on training
2.	Preparation and surface sterilization of explants.	3	Hands on training
3.	Callus induction from the leaf explants of *Datur*a/any other plant.	3+3	Hands on training
4.	Shoot initiation *in vitro*.	3+3	Hands on training
5.	Root initiation from *in vitro* formed shoots.	3+3	Hands on training
6.	Hardening and transplanting	3	Demonstration
7.	Isolation of nitrogen fixing *Rhizobium, Azotobacter, Azospirillum* and Phosphate solubilizing bacteria from soil.	3+3	Hands on training
8.	Isolation of protoplast from mesophyl tissue.	3	Hands on training
9.	Determining the viability of protoplast.	3	Hands on training
10.	Preparation of synthetic seeds.	3	Demonstration
	Total hours		**45**

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Programme Code -UBT

Course Code	Course Title	Category	L	T	P	Credit
UBT19C62	**Animal Biotechnology**	**Core-11**	**5**	**-**	**-**	**5**

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

Preamble

Understand the mammalian cell culture techniques and transgenic animal technology and acquire knowledge on the production of biotechnological molecules and preimplanted genetic diagnosis in human beings

Course Outcomes

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

#	Course Outcome	Knowledge Level (Bloom's Taxonomy)
CO1	Acquire knowledge on animal cell culture	K1
CO2	Apply the mechanisms of Gene Transfer	K2
CO3	Experiment with Transgenic animals	K3
CO4	Make use of Recombinant DNA Technology	K3
CO5	Apply knowledge in Disease Diagnosis	K3

K1 - Knowledge K2 - Understand K3 - Apply

Mapping of COs with POs

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

S -Strong M- Medium L- Low

Blooms taxonomy

	CA		End of Semester
	First	**Second**	
Knowledge	**40%**	**40%**	**40%**
Understand	**40%**	**40%**	**40%**
Apply	**20%**	**20%**	**20%**
Total Marks	**52**	**52**	**140**

Title of the paper: Animal Biotechnology

Unit : I

History & development of cell culture. Simulating natural conditions for growing animal cells. Types of media - Importance of growth factors. Primary culture anchorage dependent and non anchorage dependent cells. Secondary culture, transformed animal cells –established / continuous cell lines. Commonly used animal cells lines – their origin and characteristics. Applications of animal cell culture.

Unit : II

Transfection of mammalian cells: Calcium phosphate mediated co- transfection – microinjection – liposome mediated – electroporation - ultrasonication – – detergent mixture– use of viruses – viral vectors –SV40 and adenovirus – improved strains – basic properties.

Unit : III

Transgenic animal technology: concept of transgene and transgenics- Expression of foreign genes in transgenic mice –production of transgenic sheep for growth hormone genes – Insertion and expression of transgenes – production of transgenic cattle by pronuclear injection – collection, culture and transfer of embryos. Advantages and disadvantages of transgenesis. Transgenic animals as a model for human disease diagnosis

.

Unit : IV

Production of biotechnological molecules : Hybridoma technology.Steps involved in production of recombinant pharmaceuticals – recombinant insulin and interferons. Human growth hormone: Somatostatin and Somatotrophin – Blood products.

Unit: V

Pre implanted genetic diagnosis in human beings: Introduction, Methods and applications – IVR technology-embryo transfer technology: Gamete intra fallopian transfer technology (GIFT) and Zygote intra fallopian transfer technology (ZIFT), Multiple Ovulation Embryo Transfer (MOET). Stem cell culture. Embryonic stem cells and their applications.

Text Books:

- Ranga M. M. 2007 Animal biotechnology 3rd edition. Agrobios, Jodhpur
- Prakash. M, and K. Arora. 1998. Cell & tissue culture 1st Edition, Anomol publication, New Delhi.

- Jogdand, S. N. 2001. Advances in Biotechnology 3rd edition. Himalaya Publishing House, MUBTai.

Reference Books:

- Glick, B. R. and J. J. Pasternak. 2010. Moleculer biotechnology. Principles and application of Recombinant DNA;4th edition. ASM press Washington D.C

Course designers:

1. **S.Siva Durga**
2. **S.Yogachitra**

Course contents and lecture schedule

Unit	Topic	No of lecture hrs.	Method of Teaching
1.1	History & development of cell culture. Simulating natural conditions for growing animal cells.	2	Power Point
1.2	Types of media - Importance of growth factors.	4	Power Point
1.3	Primary culture anchorage dependent and non anchorage dependent cells	3	Black Board
1.4	Secondary culture, transformed animal cells –established / continuous cell lines	3	Power Point
1.5	Commonly used animal cells lines – their origin and characteristics. Applications of animal cell culture.	4	Power Point
2.1	Transfection of mammalian cells: Calcium phosphate mediated co-transfection – microinjection – liposome mediated – electroporation – ultrasonication	4	Black Board
2.2	Detergent mixture– use of viruses – viral vectors –SV40 and adenovirus – improved strains – basic properties	4	Power Point
3.1	Transgenic animal technology: concept of transgene and transgenics	2	Black Board
3.2	Expression of foreign genes in transgenic mice	2	Black Board
3.3	production of transgenic sheep for growth hormone genes	2	Power Point
3.4	Insertion and expression of transgenes – production of transgenic cattle by pronuclear injection – collection, culture and transfer of embryos	3	Black Board
3.5	Advantages and disadvantages of transgenesis	3	Black Board
3.6	Transgenic animals as a model for human disease diagnosis	3	Power Point
4.1	Production of biotechnological molecules: Hybridoma technology.	2	Black Board
4.2	Steps involved in production of recombinant pharmaceuticals Recombinant insulin and interferons.	4	Power Point
4.3	Human growth hormone: Somatostatin and Somatotrophin – Blood products	4	Power Point
5.1	Pre implanted genetic diagnosis in human beings: Introduction, Methods and applications – IVR technology-	4	Black Board
5.2	Embryo transfer technology: Gamete intra fallopian transfer technology (GIFT) and Zygote intra fallopian transfer technology (ZIFT), Multiple Ovulation Embryo Transfer (MOET).	4	Power Point
5.3	Stem cell culture. Embryonic stem cells and their applications	3	Power Point
	Total Hours	60	

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Course Code	Course Title	Category	L	T	P	Credit
UBT19CL62	**Animal Biotechnology Lab**	**Core Lab -9**	**-**	**-**	**3**	**2**

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

PREAMBLE

Acquire knowledge on the extraction of DNA procedures from animal tissues .Have hands training on the isolation and enumeration of cells from animal tissues.
On the completion of this course the student will be able to

#	Course Outcome	Knowledge Level (according to Bloom's Taxonomy)
CO1	Acquire knowledge on different types of bloodgroups	K1
CO2	Apply the knowledge on the preparation of cellular antigen	K3
CO3	Experiment with Antibody titration	K3
CO4	Understand the mechanisms of complement fixation	K2

K1 - Knowledge K2 - Understand K3 – Apply

Mapping of COs with POs

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

S -Strong M- Medium L- Low

Title of the paper: Animal Biotechnology lab

1. Blood grouping.
2. Haemagglutination – Immunoelectrophoresis
3. Preparation of antigens-methods of bleeding-preparation of serum.
4. Complement fixation.

5. Antibody titration
6. Lymphocytes isolation from spleen.
7. Lymphocytes isolation from blood.
8. Isolation of DNA from Blood.
9. Isolation of DNA from animal tissue (Spleen, liver)
10. Isolation and enumeration of spleenocytes and hepatocytes.
11. Total RBC count and Total WBC count (Neubauer counter)
12. Observation and assessment of animal sperm cells.

TEXT BOOKS:

- Nigel Jenkins.1999.Animal cell Biotechnology, Methods and protocols. First Edition. Humana Press.
- Jack G. Chirikijan.2009. Biotechnology theory and techniques,(Plant biotechnology, Animal Cell culture, Immuno Biotechnology).CBS publishers.
- Debajit Borah.2012. Biotechnology Lab Practice. Global Vision Publishing House.

REFERENCE BOOKS:

- Shiju Mathew.2011. Practical Manual in Biotechnology-An Experimental protocol Guide. Lambert Academic publishing.

Course designers:

1. **S.Siva DurgaS.Yogachitra**

Course contents and lecture schedule

S.No.	Experiment	No of hrs.	Method of teaching
1	Blood grouping.	3	Hands on Training.
2	Haemagglutination – Immunoelectrophoresis	5	Hands on Training.
3	Preparation of antigens-methods of bleeding-preparation of serum	4	Demonstration
4	Complement fixation.	3	Demonstration
5	Antibody titration	4	Hands on Training.
6	Lymphocytes isolation from spleen.	3	Hands on Training.
7	Lymphocytes isolation from blood.	3	Hands on Training.
8	Isolation of DNA from Blood.	4	Hands on Training.
9	Isolation of DNA from animal tissue (Spleen, liver)	4	Hands on Training.
10	Isolation and enumeration of spleenocytes and hepatocytes	4	Hands on Training.
11	Total RBC count and Total WBC count (Neubauer counter)	4	Hands on Training.
12.	Observation and assessment of animal sperm cells	4	
	Total Hours	45	

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Course Code	Course Title	Category	L	T	P	Credit
UBT19C63	**Environmental Biotechnology**	**Core- 12**	**4**	**-**	**-**	**4**

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

Preamble

Impart knowledge on concepts of environmental biotechnology and acquire knowledge on waste disposal.

Course Outcomes

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

#	Course Outcome	Knowledge Level
CO1	Apply the principles and concepts of waste water biotechnology	K3
CO2	Explain the concepts involved in effluent treatment.	K2
CO3	Make use of organic substrates for bioconversion	K3
CO4	Acquire knowledge on bioleaching.	K1
CO5	Apply the concept of bioremediation.	K3

K1 - Knowledge K2 - Understand K3 – Apply

Mapping of COs with POs

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

S -Strong M- Medium L- Low

Blooms taxonomy

	CA		End of Semester
	First	Second	
Knowledge	**40%**	**40%**	**40%**
Understand	**40%**	**40%**	**40%**
Apply	**20%**	**20%**	**20%**
Total	**52**	**52**	**140**

Title of the Paper: Environmental Biotechnology

Unit : I

Introduction and Scope of environmental biotechnology. Domestic sewage treatment –Oxidation pond - trickling filter. Activated sludge process - aerated lagoons. Drinking water treatment - Reverse Osmosis.

Unit : II

Industrial effluent treatment: Treatment of waste from diary, poultry,meat processing, canning, breweries, dye industries and radioactive product wastes.

Unit : III

Biofuel : Biogas- construction of biogas plant – composting – biogas slurry – use of compost in organic farming – Coir pith compost. Biodiesel – bioconversion of cellulose to ethanol – Hydrogen production from microbes.

Unit : IV

Microbial mining — microbial recovery of mineral resources - bioleaching of metals: copper, and uranium - Biodegradable and ecofriendly products – Bio pesticides and Bioplastics.

Unit : V

Bioremediation – types of bioremediation: *in situ* and *ex situ* - application . Phytoremediation. Xenobiotics : Microbial degradation of xenobiotics – Superbug Construction - Biodegradation of pesticides.

Text books:

- Subba rao, N.S. 2009, 4th edition. Soil microbiology. Raju Primlani Publishing Pvt. Ltd., New Delhi.
- Dash, M.C. 2011. Fundamentals of ecology, 2nd edition, Tata McGraw Hill Publishing company Ltd., New Delhi.
- Alexander Glazer, N. 2007, 2nd edition. Microbial biotechnology, Third reprint. W.H. Freeman & Company, New York.
- Dubey, R.C. 2012, third edition. A text book of microbiology, second reprint. S. Chand and Company Ltd., New Delhi.
- Pradipta Kumar Mohapatra, 2006. Text book of environmental biotechnology, I.K. International publishing house, New Delhi.

Reference Books:

- Jogdand, S. N.2015. Environmental biotechnology, 6th edition. Himalaya Publishing House, MUBTai.
- Markandy, D.K and N. Rajvaidys. 2004. Environmental Biotechnology. APH Publishing Corporation, New Delhi.

Course designer

1. **S.Yogachitra**
2. **S.Siva Durga**

Course contents and lecture schedule

Unit	Topic	No of lecture hrs.	Method Of Teaching
1.1	Introduction and Scope of environmental biotechnology.	5	Powerpoint
1.2	Domestic sewage treatment –Oxidation pond - trickling filter.	5	Powerpoint
1.3	Activated sludge process - aerated lagoons.	4	Powerpoint
1.4	Drinking water treatment - Reverse Osmosis.	4	Powerpoint
2.1	Industrial effluent treatment: Treatment of waste from diary, poultry, meat processing, canning,	4	Black board
2.2	Breweries, dye industries and radioactive product wastes.	4	Black board
3.1	Biofuel : Biogas- construction of biogas plant – composting	3	Black board
3.2	Biogas slurry – use of compost in organic farming – Coir pith compost	4	Black board
3.3	Biodiesel – bioconversion of cellulose to ethanol – Hydrogen production from microbes.	4	Powerpoint
4.1	Microbial mining — microbial recovery of mineral resources	4	Black board
4.2	Bioleaching of metals: copper, and uranium - Biodegradable and ecofriendly products	4	Black board
4.3	Bio pesticides and Bioplastics.	4	Black board
5.1	Bioremediation – types of bioremediation: *in situ* and *ex situ* - application. Phytoremediation	4	Black board
5.2	Xenobiotics : Microbial degradation of xenobiotics	4	Black board
5.3	Superbug Construction - Biodegradation of pesticides.	3	Powerpoint
	Total Hours	60	

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Course Code	Course Title	Category	L	T	P	Credit
UBT19CL63	**Environmental Biotechnology Lab**	**Core Lab -10**	**-**	**-**	**4**	**2**

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

Preamble

Acquire knowledge on the treatment of various Industrial effluents and production of ecofriendly products. Have hands on training on the physico chemical analysis of effulent.

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

#	Course Outcome	Knowledge Level (according to Bloom's Taxonomy)
CO1	Experiment with the analysis of pH,colour,odour of effluent	K3
CO2	Apply the knowledge on the extraction of biodisel	K3
CO3	Experiment with biogas production	K3
CO4	Acquire knowledge on the bioremediation procedures	K1

K1 - Knowledge K2 - Understand K3 – Apply

Mapping of COs with POs

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

S -Strong M- Medium L- Low

Title of the paper: Environmental Biotechnology lab

1. Physio -chemical characterization of effluents – colour, pH, Temp. COD & BOD.
2. Biological treatment of oil spilled effluent.
3. Bioremediation of heavy metal.
4. Biological treatment of leather effluent.
5. Study of effect of treated effluent on seed germination / plant growth

6. Demonstration of Biogas production

7. Demonstration of composting of Agricultural wastes.
8. Demonstration of composting from coir pith.
9. Extraction of Biodiesel.
10. Demonstration of bioconversion of cellulose to ethanol.
11. Demonstration of production of bioplastics.

TEXT BOOKS:

- Darshan Dharajiya, Hitesh Jasani, Vyas S. R.2015. Environmental Microbiology & Biotechnology-A Practical Manual. First Edition. SD Agricultural Universities, Sardakrushinagar.
- Gareth M. Evans & Judith C. Furlong.2012. Environmental Biotechnology: Theory and Applications. Second edition. Wiley India Pvt. Ltd.
- Bhatia S.C. 2008. A Hand book of Environmental Biotechnology.First Edition. Atlantic Publishers,UK.

REFERENCE BOOKS:

- Don L. Crawford,Ronald L. Crawford.1997. Bioremediation: Principles And Applications .First Edition. Cambridge University Press,England.
- Ram Lakhan Singh.2016.Principles & Application of Environmental Biotechnology for a Sustainable Future. First Edition.Springer Verlag, Singapore.

Course designer

1. **S.YogachitraS.Siva Durga**

Course contents and lecture schedule

S.No.	Experiment	No of hrs.	Method of teaching
1	Physio -chemical characterization of effluents – colour, pH, Temp. COD & BOD.	5	Hands on Training.
2	Biological treatment of oil spilled effluent	5	Hands on Training.
3	Bioremediation of heavy metal.	7	Hands on Training.
4	Biological treatment of leather effluent.	7	Demonstration
5	Study of effect of treated effluent on seed germination / plant growth	3	Hands on Training.
6	Demonstration of Biogas production	7	Demonstration
7	Demonstration of composting of Agricultural wastes.	7	Demonstration
8	Demonstration of composting from coir pith.	7	Demonstration
9	Extraction of Biodiesel.	3	Hands on Training.
10	Demonstration of bioconversion of cellulose to ethanol	7	Demonstration
11	Demonstration of production of bioplastics	2	Demonstration
	Total Hours	60	

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Course Code	Course Title	Category	L	T	P	Credit
UBT19CE61(D)	**Genomics**	**Core Elective-2**	**4**	**-**	**-**	**5**

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

Preamble

To endow the students with the basic knowledge on genome organization and comparative analysis of different genomes.

Course Outcomes

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

#	Course Outcome	Knowledge Level (Bloom's Taxonomy)
CO1	Explore the evolutionary context of genome organization in prokaryotes and eukaryotes	K1
CO2	Analyze different levels of organization and significance of nuclear and organelle genomes.	K2
CO3	Prepare to contrast the advantages of modern functional genomics assays.	K2
CO4	Illustrate the plant, animal and microbial genome organization with reference to their physiological adaptations and association with other levels of organisms.	K3
CO5	Elucidate the applications of genomic tools in clinical diagnosis and molecular homology analysis.	K3

K1 - Knowledge K2 - Understand K3 - Apply

Mapping of COs with POs

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

S -Strong M- Medium L- Low

Blooms Taxonomy

	CA		End of Semester
	First	Second	
Knowledge	40%	40%	40%
Understand	40%	40%	40%
Apply	20%	20%	20%
Total Marks	52	52	140

Title of the paper: Genomics

Unit I: Introduction to Genomics: Structure and organization of prokaryotic and eukaryotic genomes – nuclear, mitochondrial and chloroplast genomes – interaction between nuclear and chloroplast genome.

Unit II: Structural genomics: Automated DNA sequencing - Genome mapping projects – Human, microbes, plants and animals – viral genome - comparative genomics of Prokaryotes and Eukaryotes.

Unit III: Functional genomics: Gene prediction methods- classical, novel methods; Neural networks, Micro array – cDNA, Oligo nucleotide Microarray. Personal genomics.

Unit IV: Plant Genomics: gene expression pattern in photosynthesis and nitrogen fixation- Rubisco and carbon dioxide fixation-Nif genes organization, expression and control system. Genomic approaches on plant symbiotic association.

Unit V: Animal Genomics: Gene expression pattern in normal cells – pathological conditions. Analysis of gene expression variability-cDNA-RFLP analysis. Immunogenomics- immunogenicity. Microbial genomics-multidrug resistance. Environmental genomics-genomic tools for environmental monitoring. Metagenomics.

Text Book

- Cantor. C and C.W. Smith, 2000, Genomics: The Science and Technology Behind the Human Genome Project, wlley – Interscience, New York.
- Arthur M Lesk, 2008. Introduction to genomics. Oxford University Press, Oxford.
- Primrose, S.B. and R.M. Twyman, 2007. Principles of Genome Analysis and genomics, Blackwell publishing, USA.
- Wilkins. M. R., K. L. Wilkins., R.D. Appel and Hochstrasser, 1997. Proteome Research and New Frontires in Functional Genomics Spring – Velag New York,.
- Walsh G and Haeden, 1994. Protein Biotechnology, John Wiley and sons.

Reference Books:

- Davies. J.M. 1995. Genome Analysis – A Practical Approach, Oxford University Press. Oxford.
- Dear. P.H. 1997. Genome Mapping _ A Practical Approach, Oxford University Press, Oxford.

- Vestermeier, R and T Naven. 2002. Proteomics in practice: a laboratory manual of genome analysis . Wiley – VCH, Weinheim ISBN 357303545.
- Liebler, C. C. 2002 Introduction to proteomics: Tools for the new biology Human, press, Totowa, NJ. ISBN 0585418799
- Link A.L., 1998 2-D Proteome Analysis Protocols, Human press, Totowa, NJ.

Course designed by:
Dr. K. Thangavel

Course contents and lecture schedule

Unit	Topic	Lecture hrs.	Method of Teaching
1.1	Introduction to Genomics	2	Black Board
1.2	Structure and organization of prokaryotic genomes	2	Black Board
1.3	Structure and organization of eukaryotic genomes	3	Power Point
1.4	Nuclear genomes	3	Power Point
1.5	Mitochondrial and chloroplast genomes	3	Power Point
1.6	Interaction between nuclear and chloroplast genome	3	Power Point
2.1	Structural genomics	2	Power Point
2.2	Automated DNA sequencing	3	Power Point
2.3	Genome mapping projects	3	Power Point
2.4	Human genome	2	Power Point
2.5	Plants and animal genomes	2	Black Board
2.6	Microbial genomes	2	Black Board
2.7	Viral genome. Comparative genomics of Prokaryotes and Eukaryotes.	3	Power Point
3.1	Functional genomics	3	Black Board
3.2	Gene prediction methods - Classical , Novel methods, Neural networks	3	Power Point
3.4	Micro array – cDNA, Oligo nucleotide Microarray.	3	Black Board
4.1	Plant Genomics: gene expression pattern in photosynthesis and nitrogen fixation.	3	Black Board
4.2	Genomic approaches on plant symbiotic association	2	
5.1	Animal Genomics: Gene expression pattern in normal cells – pathological conditions.	4	Power Point
5.2	Analysis of gene expression variability-cDNA-RFLP analysis.	4	Power Point
	Immunogenomics- immunogenicity.		
5.3	Microbial genomics-multidrug resistance. Environmental genomics-genomic tools for environmental monitoring.	3	Power Point
5.4	Metagenomics	2	Power Point
Total hours		**60 .**	

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Course Code	Course Title	Category	L	T	P	Credit
UBT19CE61(E)	**Food Biotechnology**	**Core elective -2**	**4**	**-**	**-**	**5**

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

Preamble

To enlighten the students with the facts related to future of food industry and the role of biotechnology in the food industry.

Course Outcomes

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

#	Course Outcome	Knowledge Level (according to Bloom's Taxonomy)
CO1	Learn pertinent facts concerning the role of microorganisms in food preservation, spoilage, and food poisoning.	K1
CO2	Learn the role and significance of various indicator and disease-producing microorganisms in food, water, and wastewater.	K2
CO3	Evaluate standard procedures to detect microorganisms in food, water, and wastewater.	K3
CO4	Overview about industrially important food products	K3
CO5	Grab an idea about food spoilage and preservation in food industry.	K1

K1 - Knowledge K2 - Understand K3 - Apply

Mapping of COs with POs

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

S -Strong M- Medium L- Low

Blooms taxonomy

	CA		End of Semester
	First	**Second**	
Knowledge	**40%**	**40%**	**40%**
Understand	**40%**	**40%**	**40%**
Apply	**20%**	**20%**	**20%**
Total Marks	**52**	**52**	**140**

Title of the paper: Food Biotechnology

Unit I

Introduction to food microbiology - Scope of food microbiology, food as a Substrate for microorganisms, microorganisms important in food industry

Unit II

Microbial production: Process of Bread Production - Fermented Dairy Products – Cheese Production and Types, Buttermilk, Sour cream, Yoghurt .

Unit III

Fermented vegetables: Sauerkraut, Olives, Soy Sauce & Pickles. Other food Products: Fermented meat, Idli batter. Microbes as food, SCP. Intrinsic and Extrinsic parameters of foods that influence microbial growth. Oriental Fermented food.

Unit IV

Food Spoilage: Spoilage of vegetables and fruits. Spoilage of meat & canned food. Spoilage of Milk and Milk products. Indicators of pathogens associated with Food. Food poisoning: by *Aspergillus flavus* &*Clostridium botulinum*

Unit V

Food Preservation: Physical methods: Asepsis, filtration & centrifugation, high & low temperature & Pasteurization, desiccation, radiation, anaerobiosis, canning and controlled atmosphere. Chemical preservation: Salt, Sugar, organic acid (Benzoic acid, Sorbic acid, propionates, acetic acid & lactic acid), nitrates, nitrites, sulfur dioxide, ethylene dioxide, propylene oxide, wood smoke and antibiotics

Text Books:

- Adams, M.R and M.O.Moss, 1996, Food microbiology, New Age international (P) Ltd., New Delhi.
- Frazier,W.C., and D.C.Westhoff, 1988, (Reprint 1995), Food Microbiology, Fourth edition, Tata McGraw-Hill Publishing Ltd., New Delhi.

Reference Books:

- Atlas,R.M., 1997, Principles of Microbiology, Second edition, WCB/McGraw Hill, U.S.A.,
- Banwart,G.J., 1987, Basic Food Microbiology, CBS Publishers & Distributors, New Delhi.
- Deak, T, and L.R.Beuchat, 1996, Hand Book of Food Spoilage Yeasts, CRC Press, New York.

- Garbutt,J., 1997, Essentials of Food Microbiology, Arnold-International Students‘ edition, London.
- Jay,J.M, 1996, Modern Food Microbiology, CBS Publishers & Distributors, New Delhi.
- Joshi,V.K. and Ashok Pandey (Eds), 1999, Biotechnology: Food fermentation Vol.II, Educational Publishers and Distributors, New Delhi.
- Kulshreshtha, S.K. 1994, Food Preservation, Vikas Publishing House Pvt. Ltd., New Delhi

Course Designer:
G. Ramya vaideki

Course contents and lecture schedule

Unit	Topic	No of lecture hrs.	Method
1.1	Introduction to food microbiology - Scope of food microbiology,	2	Black board
1.2	food as a Substrate for microorganisms, microorganisms important in food industry,	4	Black board
2.1	Microbial production: Process of Bread Production	4	PowerPoint
2.2	Fermented Dairy Products – Cheese Production and Types, Buttermilk, Sour cream, Yoghurt .	5	Black board
3.1	Fermented vegetables: Sauerkraut, Olives.	2	Black board
3.2	, Soy Sauce & Pickles. Other food Products: Fermented meat, Idli batter	4	Black board
3.3	Microbes as food, SCP.	2	Black board
3.4	Intrinsic and Extrinsic parameters of foods that influence microbial growth. Oriental Fermented food.	4	Black board
4.1	Food Spoilage: Spoilage of vegetables and fruits.	4	Black board
4.2	Spoilage of meat & canned food.	3	Black board
4.3	Spoilage of Milk and Milk products.	4	PowerPoint
4.4	Indicators of pathogens associated with Food. Food poisoning: by *Aspergillus flavus* &*Clostridium botulinum*	5	PowerPoint
5.1	Food Preservation: Physical methods: Asepsis, filtration & centrifugation,	5	Black board
5.2	high & low temperature & Pasteurization, desiccation,	4	PowerPoint
5.3	radiation, anaerobiosis, canning and controlled atmosphere.	4	Black board
5.5	Chemical preservation: Salt, Sugar, organic acid (Benzoic acid, Sorbic acid, propionates, acetic acid & lactic acid), nitrates, nitrites, sulfur dioxide, ethylene dioxide, propylene oxide, wood smoke and antibiotics	4	Black board
		Total hours	60

Thiagarajar College : Madurai – 625 009
Department of Botany
(For those joined B.Sc. Biotechnology on or after June 2019)
Programme Code -UBT

CourseCode	Course Title	Category	L	T	P	Credit
UBT19CE61(F)	**Biosafety and Intellectual Property Rights**	**Core Elective-2**	**4**	**-**	**-**	**5**

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

Preamble

Acquire knowledge on various concepts of IPR and develop a sense of responsibility towards Biosafety.

Course Outcomes

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

#	Course Outcome	Knowledge Level (Bloom's Taxonomy)
CO1	Acquire knowledge on various concepts of IPR.	K1
CO2	Apply the knowledge of Patenting.	K2
CO3	Analyze the concepts of biohazards.	K2
CO4	Make use of knowledge in biosafety	K3
CO5	Develop mechanisms to protect traditional knowledge	K3

K1 - Knowledge K2 - Understand K3 - Apply

Mapping of COs with POs

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

S -Strong M- Medium L- Low

Blooms taxonomy

	CA		End of Semester
	First	Second	
Knowledge	**40%**	**40%**	**40%**
Understand	**40%**	**40%**	**40%**
Apply	**20%**	**20%**	**20%**
Total Marks	**52**	**52**	**140**

Title of the paper: Biosafety and Intellectual Property Rights

Unit I:
World Trade Organization (WTO) – General Agreement on Tariffs and Trade (GATT) & Trade Related Intellectual Property Rights (TRIPs). Convention on International Trade on Endangered species(CITES) - Role of Non-government organization in different countries-RED data book.

Unit II
Intellectual Property Rights - Different types of intellectual property rights. Origin of patent Regime - Patent System in India - Patent application – Basis of patentability – nonpatentable inventions.

Unit III:
Biohazards – Risk assessment – Risk Groups – Containment levels. Biosafety - general guide lines - guide lines for rDNA research activity - guidelines for research in genetically manipulated microbial strains: Genetically Modified Organisms (GMO'S) and Bio safety in releasing Transgenic Animals and plants.

Unit IV
Institutional biosafety Committee (IBSC) – Functions of IBSCs – Organization network. Status of Government strategies in r DNA technology and human gene cloning. CPCSEA – Guidelines for laboratory animal facility - National Good Laboratory Practice Programme – GLP authority functions – standard tests for clinical trials.

Unit V
Protection of traditional knowledge – biopiracy – documentation of traditional knowledge – some case studies – basmati rice issue - revocation of turmeric and neem patent. Indigenous knowledge – kani tribe - jeevani.

Text Books:

- Brown. T.A., 2000. Gene cloning, Seventh edition. Chapman & Hall Publication, New York.
- Casida, L.E. Jr. 2015. Industrial Microbiology. New age International Publishers, New Delhi.
- Dubey, R.C. 2006, 4^{th} edition. a Text book of Biotechnology .S. Chand & Co, New Delhi.
- Jogdand,. S. N 2001. Advances in Biotechnology 3rd edition; Himalaya Publishing House, MUBTai.
- Old, R. W. and S. B. Primrose. 1994. Principles of gene manipulation. An introduction to genetic engineering, 5th edition. Blackwell Science Ltd.,
- Patel, A.H. 2016, 2^{nd} edition. Industrial Microbiology. Macmillan India Ltd, Delhi.

Reference book:

- Glick, B.R. and J.J. Pasternak. 2010. Molecular biotechnology. Principles and application of Recombinant DNA , 4^{th}edition. ASM press, Washington D.C.

Course Designer: 1.S.Yogachitra.

Course contents and lecture schedule

Unit	Topic	No of lecture hrs.	Method of teaching
1.1	World Trade Organization (WTO) – General Agreement on Tariffs and Trade (GATT) & Trade Related Intellectual Property Rights (TRIPs).	5	Black Board
1.2	Convention on International Trade on Endangered species(CITES) - Role of Non-government organization in different countries-RED data book	5	Black Board
2.1	Intellectual Property Rights - Different types of intellectual property rights	4	Black Board
2.2	Origin of patent Regime - Patent System in India - Patent application – Basis of patentability – nonpatentable inventions	5	Black Board
3.1	Biohazards – Risk assessment – Risk Groups – Containment levels. Biosafety - general guide lines - guide lines for rDNA research activity	4	Power Point
3.2	guidelines for research in genetically manipulated microbial strains: Genetically Modified Organisms (GMO‘S)	4	Power Point
3.3	Bio safety in releasing Transgenic Animals and plants.	3	Black Board
4.1	Institutional biosafety Committee (IBSC) – Functions of IBSCs – Organization network	4	Power Point
4.2	Status of Government strategies in r DNA technology and human gene cloning. CPCSEA – Guidelines for laboratory animal facility	4	Power Point
4.3	National Good Laboratory Practice Programme – GLP authority functions – standard tests for clinical trials.	4	Power Point
5.1	Protection of traditional knowledge – biopiracy – documentation of traditional knowledge	4	Black Board
5.2	some case studies – basmati rice issue	5	Black Board
5.3	- revocation of turmeric and neem patent	5	Power Point
5.4	Indigenous knowledge – kani tribe – jeevani	4	Black Board
	Total Hours	60	

Thiagarajar College : Madurai – 625 009
Department of Botany
(For those joined B.Sc. Biotechnology on or after June 2019)
Programme Code -UBT

Course Code	Course Title	Category	L	T	P	Credit
UBTCE61(G)	Biodiversity and Conservation	CoreElective-2	4	-	-	5

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

Preamble

To endow the students with the basic knowledge on biodiversity, its types and various conservation strategies.

Course Outcomes

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

#	Course Outcome	Knowledge Level (Bloom's Taxonomy)
CO1	Analyze the basis and various levels of biodiversity	K1
CO2	Evaluate different modes of biodiversity assessment	K2
CO3	Demonstrate the habitat specific adaptations in different organism.	K2
CO4	Illustrate the factors affecting biodiversity and address various forms of threat to biodiversity.	K3
CO5	Appraise biodiversity conservation strategies, legislations and role of regional, national and international organizations in biodiversity conservation.	K3

K1 - Knowledge K2 - Understand K3 - Apply

Mapping of COs with POs

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

S -Strong M- Medium L- Low

Blooms Taxonomy

	CA		End of Semester
	First	**Second**	
Knowledge	**40%**	**40%**	**40%**
Understand	**40%**	**40%**	**40%**
Apply	**20%**	**20%**	**20%**
Total Marks	**52**	**52**	**140**

Title of the paper: Biodiversity and Conservation

Unit I: Introduction: Definition, concepts and types of biodiversity, importance and conservation needs. Species diversity, Biological and phylogenetic species concept. Basic concepts of speciation, species extinction. Genetic diversity. origin of new genetic material, isolation and origin of new species.

Unit II: General characteristics, habitat and economic importance of photosynthetic bacteria-blue-green algae. Microbial toxins in environment, microbial diseases of man. Food, timber and medicinal plants. Importance of tropical rain forests and wetlands.

Unit III: Factors affecting biodiversity: Demography pressures, over exploitation, deforestation, water dams and river valley projects, mines, grazing of grasslands. Biodiversity informatics: Documenting biodiversity, biodiversity databases-Red data, Blue data and Green Book and Biodiversity registers.

Unit IV: Ex situ Conservation: Principles, seed banks, pollen storage, tissue culture, germplasm bank, vegetative propagation, cultivation involving local and tribal communities, botanical gardens. In situ Conservation: principles, biosphere reserves, protected areas network, national parks, sacred groves and wildlife sanctuaries.

Unit V: Global biodiversity information system- species 2000 and Tree of life – overview of the UNEP/GEF biodiversity data management project (BDM) – CBD, NBDA and bioethics.

Reference Books

1. Agarwal , K.C. 2005. Biodiversity Principles and Conservation, International Book Distributors, Dehradun.
2. Krishnamurthy K.V. 2004. An advanced text book on Biodiversity; Principles and practice, Oxford and IBH, New Delhi. 260pp.
3. Groombridge, B. (Ed). 1994. Global Biodiversity: Status of Earths Living resources, Chapman & Hall, London.
4. Chowdhery, H.J. and Murti, S.K. 2000. Plant Diversity and Conservation in India: An overview. Bishen Singh Mahendra Pal Singh Publishers, Dehra Dun.
5. IUCN, 1980. WORLD Conservation Strategy: prepared by IUCN and Natural Sources, UNEP, WWF, FAO, UNESCO.
6. Kandya, A.K. 2007. Biodiversity Conservation and Legal Aspects, International Book Distributors, Dehradun.
7. Kumar, 2005. Biodiversity Principles and Conservation. International Book Distributions, Dehradun.

Text Books

- Chandel, K.P.S., Shukla, G. And Sharma, N. (1996). Biodiversity in Medicinal and Aromatic Plants in India Conservation and Utilization, National Bureau of Plant Genetic Resources, New Delhi.
- Council of Scientific and Industrial Research (1986). The Useful Plants of India Publication and Information Directorate, CSIR, New Delhi.
- Nair, M.N.B. et. al. (Eds.) (1998). Sustainable Management of Non-wood Forest Products. Faculty of Forestry, University Putra. Malaysia. 434 004 PM Serdong, Selangor, Malaysia.
- Soule, M.E. (ed.) (1986). Conservation Biology. The Science of Scarcity and Diversity. Sinaur Associates, Inc., Sunderland, Massachusetts.

Course designed by: Dr. K. Thangavel

Course contents and lecture schedule

Unit	Topic	Lecture hrs.	Method
1.1	Introduction to biodiversity- Definition, concepts and types of biodiversity.	2	Black board
1.2	Biodiversity- its importance and conservation needs.	2	Power point
1.2	Species diversity, Biological and phylogenetic species concept.	3	Power point
1.3	Basic concepts of speciation, species extinction. Genetic diversity.	4	Power point
1.4	Origin of new genetic material, isolation and origin of new species.	4	Black/White board
2.1	General characteristics, habitat and economic importance of photosynthetic bacteria-blue-green algae.	4	Power point
2.2	Microbial toxins in environment, microbial diseases of man.	3	Black/White board
2.3	Products of biodiversity-Food, timber and medicinal plants.	2	Black/White board
2.4	Importance of tropical rain forests and wetlands.	4	Black/White board
3.1	Factors affecting biodiversity: Demography pressures, over exploitation,	4	Black/White board
3.2	Deforestation, water dams and river valley projects, mines, grazing of grasslands.	3	Power point
3.3	Biodiversity informatics: Documenting biodiversity, biodiversity databases-Red data,	4	Power point
3.4	Blue data and Green Book and Biodiversity registers.	4	Black/White board
4.1	Ex situ Conservation: Principles, seed banks, pollen storage, tissue culture, germplasm bank, vegetative propagation, cultivation involving local and tribal communities, botanical gardens.	4	Power point

4.2	In situ Conservation: principles, biosphere reserves, protected areas network, national parks, sacred groves and wildlife sanctuaries.	4	Power point
5.1	Global biodiversity information system- species 2000 and Tree of life – overview of the UNEP/GEF biodiversity data management project (BDM) – CBD, NBDA and bioethics.	5	Black/White board
5.2	Biodiversity data management project (BDM) – CBD, NBDA and bioethics.	4	Black/White board
Total hours			**60**

Thiagarajar College : Madurai – 625 009
Department of Botany
(For those joined B.Sc. Biotechnology on or after June 2019)
Programme Code -UBT

Course Code	Course Title	Category	L	T	P	Credit
UBT19SE61 (D)	Herbal Medicine	SEC2	2	-	-	2

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

Preamble

Realize the significance of medicinal plants. Experiential learning of preparation and processing of natural drugs.

Course Outcomes

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

#	Course Outcome	Knowledge Level (Bloom's Taxonomy)
CO1	Acquire knowledge on natural medicine	K1
CO2	Apply the techniques of processing	K3
CO3	Acquire knowledge of chemistry of natural medicines	K1
CO4	Make use of preparative methods of herbal medicines	K3

K1 - Knowledge K2 - Understand K3 - Apply

Mapping of COs with POs

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

S -Strong M- Medium L- Low

Blooms taxonomy

	CA		End of Semester
	First	Second	
Knowledge	40%	40%	40%
Understand	40%	40%	40%
Apply	20%	20%	20%
Total Marks	52	52	140

Title of the paper : Herbal Medicine

Unit I:
Classification of drugs based on morphology, pharmacological and chemical nature. – Herbs used in Siddha, Ayurveda, Unani and Homoeopathy - A general account on collection, harvesting, drying, garbling and packing. Methods to detect drug adulteration.

Unit II:
Chemical nature of natural medicines: Brief study on general properties, Classification, uses and chemical test of the following: Alkaloids, Terpenoids, Glycosides, Lipids, Volatile oils and tannins.
Various methods for the preparation of drugs - Preparation of commercial drugs – Juice, Paste, Extract, Infusion, Decoction, Mixture, Powder, Syrup, Fomentation and Medicated oil.

Text Books:

- Kumar, N.C. 1993. An introduction to medical Botany and pharmocognosy. Emkay publication, New Delhi,
- Kokate, C.K, Purohit, A.P. Gokhale, C.B.2003. Pharmacognosy Nirali prakashan, Pune.
- Pal, D.C. and Jain, S.K. 1998. Tribal medicine, Naya prokash, Calcutta.

Reference Books:

- Wallis, T.E.1985. Text Book of Pharmacognosy. CBS publishers and Distributors, Delhi.
- Mohammed Ali, 1998 Text Book of Pharmacognosy CBS publishers and Distributors, New Delhi.

Course designed by:

1. S. Siva Durga S. Yoga chitra

Course contents and lecture schedule

Unit	Topic	Lecture hrs.	Method of Teaching
1.1	Classification of drugs based on morphology, pharmacological and chemical nature.	3	Power point
1.2	Herbs used in Siddha, Ayurveda, Unani - and Homoeopathy	4	Blackboard
1.3	A general account on collection, harvesting, drying, garbling and packing	4	Blackboard
1.4	Methods to detect drug adulteration	2	Blackboard
2.1	Chemical nature of natural medicines: Brief study on general properties, Classification,	5	Power point
2.2	uses and chemical test of the following: Alkaloids, Terpenoids, Glycosides, Lipids, Volatile oils and tannins	3	Blackboard
2.3	Various methods for the preparation of drugs	3	Blackboard
2.4	- Preparation of commercial drugs – Juice, Paste, Extract, Infusion, Decoction, Mixture, Powder, Syrup, Fomentation and Medicated oil.	6	Power point /demo
	Total Hours	30	

Thiagarajar College : Madurai – 625 009
Department of Botany
(For those joined B.Sc. Biotechnology on or after June 2019)
Programme Code -UBT

CourseCode	Course Title	Category	L	T	P	Credit
UBT19SE61(E)	**Health and Hygiene**	**SEC2**	**2**	**-**	**-**	**2**

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

Preamble

The course delineates the practices and determinants of good health and hygiene.

Course Outcomes

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

#	Course Outcome	Knowledge Level (Bloom's Taxonomy)
CO1	Grab an idea about the proper nutrition and the causes of malnutrition condition.	K1
CO2	Depict the need for balanced diet.	K2
CO3	Concede the need for hygienic practices.	K3
CO4	Understand the causes, effects and prevention of air, water and noise pollutions.	K2
CO5	Analyse the need for disease control and quality standards of air, water and noise pollution.	K3

K1 - Knowledge K2 - Understand K3 - Apply

Mapping of COs with POs

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

S -Strong M- Medium L- Low

Blooms taxonomy

	CA		End of Semester
	First	**Second**	
Knowledge	**40%**	**40%**	**40%**
Understand	**40%**	**40%**	**40%**
Apply	**20%**	**20%**	**20%**
Total Marks	**52**	**52**	**140**

Title of the paper: Health and Hygiene

UNIT I

Dimensions and Determinants of health, Indicators of health .Nutrition – Classification and functions of food, sources and requirement of Carbohydrates, Proteins, Fats, Vitamins and Minerals. Malnutrition – Protein energy Malnutrition (PEM), Balanced diet – Composition of balanced diet.
Disease agents – Classification of disease agents- water, air, vector borne

Unit II

Water – Safe and wholesome water, criteria for water quality standards, household purification of water. Air – Health effects of air pollution, prevention and control Ventilation – Standards of ventilation. Light – The requirements of good lighting, Noise – Effects of noise exposure, Types of mental illness – Major and minor illnesses, Causes of mental ill health – Social pathological causes, Preventive aspects. Immunization – Vaccines and Immunization Schedule, Principles of disease control and prevention.

Text Books:

1. Murugesh, N. 2002. Health education and community pharmacy, 3rd Edition, Sathya Publishers, Madurai.

2. Park, J.E. and Park. 2000. Text book of preventive and social medicine, 17th Edition, Banarasidas Publishers, Jabalpur.

Course Designer:
G. Ramya vaideki

Course contents and lecture schedule

Unit	Topic	No of lecture hrs.	Method
1.1	Dimensions and Determinants of health, Indicators of health	3	PowerPoint
1.2	Nutrition – Classification and functions of food, sources and requirement of Carbohydrates, Proteins, Fats, Vitamins and Minerals.	4	PowerPoint
1.3	Malnutrition – Protein energy Malnutrition (PEM), Balanced diet – Composition of balanced diet. Disease agents – Classification of disease agents-water, air, vector borne	4	Black board
1.4	Disease agents – Classification of disease agents-water, air, vector borne	3	Black board
2.1	Water – Safe and wholesome water, criteria for water quality standards, household purification of water.	3	PowerPoint
2.2	Air – Health effects of air pollution, prevention and control Ventilation – Standards of ventilation. Light – The requirements of good lighting,	4	PowerPoint
2.3	Noise – Effects of noise exposure, Types of mental illness	3	PowerPoint
2.4	Major and minor illnesses, Causes of mental ill health – Social pathological causes, Preventive aspects	3	PowerPoint
2.5	Immunization – Vaccines and Immunization Schedule, Principles of disease control and prevention.	3	Black board
		Total hours	30

Thiagarajar College : Madurai – 625 009
Department of Botany
(For those joined B.Sc. Biotechnology on or after June 2019)
Programme Code -UBT

CourseCode	Course Title	Category	L	T	P	Credit
UBT19SE61(F)	**Microscopy and Microtechniques**	**SEC2**	**2**	**-**	**-**	**2**

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

Preamble

Enables the students to comprehend the principles, types and applications of different microscopes and microtechniques involved in the specimen preparation for microscopy.

Course Outcomes

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

#	Course Outcome	Knowledge Level (Bloom's Taxonomy)
CO1	Understand the importance of microscopy in the field of science	K2
CO2	Acquire knowledge on the advanced forms of microscopes	K1
CO3	Differentiate the types of microscopes, their principles and its application.	K3
CO4	Know the process involved in the specimen preparation for microscopy	K3
CO5	Grab a basic idea about the automated microscopy techniques	K1

K1 - Knowledge K2 - Understand K3 - Apply

Mapping of COs with POs

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

Blooms taxonomy

	CA		End of Semester
	First	**Second**	
Knowledge	**40%**	**40%**	**40%**
Understand	**40%**	**40%**	**40%**
Apply	**20%**	**20%**	**20%**
Total Marks	**52**	**52**	**140**

Title of the paper: Microscopy and Microtechniques

Unit I

Microscopy: simple and compound microscope, Light, Dark field, Phase contrast, electron microscopy-Scanning and Transmission-Principles and applications. Cytophotometry flow cytometry

Unit II

Microtechnique: Preparation of specimen for light microscope. Preparation of specimen for SEM and TEM- Fixation, sectioning – Mounting- Use of ultra microtome.Freeze drying and freeze substitution.

Text Books:

1. Wilson,K and Goulding,K.H.1992.A Biological guide to principles and techniques of practical biochemistry. Cambridge university press , Cambridge.

Reference books:

1.Plummer, D.T.1987.An introduction to practical Biochemistry. Tata MC Graw- Hill publishing company Ltd.New Delhi.

Course Designer:

G. Ramya vaideki

Course contents and lecture schedule

Unit	Topic	lecture hrs.	Teaching Method
1.1	Microscopy: simple and compound microscope	4	Black board
1.2	Light, Dark field, Phase contrast ,electron microscopy-Scanning	5	PowerPoint
1.3	Trasnmission-Principles and applications	4	PowerPoint
1.4	Cytophotometry flow cytometry	4	PowerPoint
2.1	Microtechnique: Preparation of specimen for light microscope	4	Black board
2.2	Preparation of specimen for SEM and TEM- Fixation, sectioning – Mounting	4	PowerPoint
2.3	Use of ultra microtome.Freeze drying and freeze substitution	5	Black board
		Total hours	30

Thiagarajar College (Autonomous): Madurai – 625 009
Department of Botany
(For those joined B.Sc. Biotechnology on or after June 2019)

Course Code	Course Title	Category	L	T	P	Credit
UBT19NE51	**Vocational Biotechnology**	NME2	**2**	**-**	**-**	**2**

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

Preamble

- Enables the students to comprehend the preparation and applications of organic manures, and microbial products for domestic and industrial applications.

Course Outcomes

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

#	Course Outcome	Knowledge Level Bloom's Taxonomy)
CO1	Understand the importance of organic manure and microbial products	K2
CO2	Acquire knowledge on the applications of organic and microbial formulations	K1
CO3	Differentiate the types of cultivation system for spirullina and other nutritional important algal species.	K3
CO4	Know the process involved in the probiotics preparation	K3

K1 - Knowledge K2 - Understand K3 - Apply

Mapping of COs with POs

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

S-Strong M- Medium L-Low

Blooms Taxonomy

	CA		End of Semester
	First	**Second**	
Knowledge	**40%**	**40%**	**40%**
Understand	**40%**	**40%**	**40%**
Apply	**20%**	**20%**	**20%**
Total Marks	**30**	**30**	**65**

Title of the paper: Vocational Biotechnology

Unit I:

Organic farming technology: composting methods - indoor and Berkley method- Vermiculture . Vermicomposting - vermiwash - preparatioin of panchakavya and its applications. Advantages of organic farming.

Unit II:

Microbial protein production technology: Cultivation methods for Algae-Spirullina ,fungal -yeast- importance of single cell protein. Microbes as probiotics-lactobacillus.

Text books:

- Dubey. R. C. 2002. A text book of biotechnology S. Chand & Co, New Delhi.
- Casida, L.E.2001 industrial microbiology new age international publication. new Delhi.

Reference books:

- Venkataraman , L.V. and E.W. Beaker 1985.Biotechnology and utilization of algae. the Indian experience. CFTRI Mysore pp 257.

Course designed by: S. Sivadurga

Unit	Topic	Lecture hrs.	Teaching Method
1.1	Organic farming technology	2	Black board
1.2	Composting methods	2	Black board
1.3	Indoor and Berkley method	1	Black board
1.4	Vermiculture .	2	Black board
1.5	Vermicomposting	2	Black board
1.6	Vermiwash	2	Black board
1.7	Preparatioin of panchakavya and its applications.	2	Black board
1.8	Advantages of organic farming.	1	Black board
2.1	Microbial protein production technology	4	Black board
2.2	Cultivation methods for Algal-Spirulina ,fungal -yeast-	4	Black board
2.3	Importance of single cell protein .	4	Black board
2.4	Microbes as probiotics-lactobacillus	4	Black board
	Total hours	**30**	

THIAGARAJAR COLLEGE, MADURAI – 9.

(Re-Accredited with 'A' Grade by NAAC)

ENVIRONMENTAL STUDIES

(For those joined B.A., B.Sc., B.Com., B.B.A., B.C.A on or after June 2019)

Course Code	Course Title	Category	L	T	P	Credit
U19EVS11	**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 Pollutants	K1
CO4	Perceive the environment legislations in India for sustainable development.	K3

K1: Knowledge K2: Understand K3: Apply

Blooms taxonomy: Assessment Pattern

	CA		End of Semester
	First	**Second**	
Knowledge	40%	40%	40%
Understand	40%	40%	40%
Apply	20%	20%	20%

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 PSOllution – Water PSOllution – Noise PSOllution – Nuclear Hazards. Solid waste management and Waste DisPSOsal 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

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

Reference Books

2. Yogendra, N. and Srivastava, N. 1998. Environmental PSOllution, Ashish Publishing House. New Delhi.

Sapru R.K.2001. Environment Management in India, Vol. I & Vol. II Ashish publishers house, New Delhi.

THIAGARAJAR COLLEGE, MADURAI – 9.

(Re-Accredited with 'A' Grade by NAAC)

VALUE EDUCATION

(For those joined B.A., B.Sc., B.Com., B.B.A., B.C.A on or after June 2019)

Course Code	Course Title	Category	L	T	P	Credit
U19VE51	**Value Education**	AECC1	2	-	-	2

Year	Semester	Int. Marks	Ext.Marks	Total
Third	Fifth	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

Blooms taxonomy: Assessment Pattern

	CA		End of Semester
	First	Second	
Knowledge	40%	40%	40%
Understand	40%	40%	40%
Apply	20%	20%	20%

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

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

விழுமியக் கல்வி

கூறு - 1

சுய முன்னேற்றம்

அறிமுகம் - விழுமியங்களின் விளக்கம் மற்றும் வகைகள் - சுயமதிப்பீடு - சுய முன்னேற்றத்திற்கு விழுமியங்களின் தேவை - குடும்ப வாழ்க்கைக்கு விழுமியங்களின் தேவை - மகிழ்ச்சியான வாழ்க்கைக்கான கொள்கைகள்

பண்பு வளர்ச்சி

நற்பண்பு - நல்லுறவு - உயரிய பண்புகளால் உயர்ந்த பெருமக்களாதல் - பண்புகளைத் தேடல் - பண்புகளை வளர்த்தல் - நற்பண்புகளுக்கான திறவுகோல்.

கூறு - 2

சுயமரியாதையும் நேர்மறைச் சிந்தனையும்

சிந்தனையின் வகைகள் - சிந்தனைப் பகுதிகள் - சிந்தனையை வளர்க்கும் முறை - சிந்தனையில் புறத்தாக்கங்கள் - நேர்மறைப் பண்பை வெளித்தோற்றத்தில் காட்டும்முறை - சுயமரியாதையின் பொருள் - சுய அதிகாரமளித்தல்

அழுத்தமில்லா வாழ்க்கை

பிரமைகளும் காரணங்களும் - அழுத்த நிலைகளுக்கான அறிகுறிகள் - தன்னம்பிக்கை - தலைமைப் பண்பில் முன்னுதாரணங்கள் - விமர்சனச் சிந்தனை - தொடர்புத் திறன்கள் - மகிழ்ச்சி மற்றும் வெற்றிகரமான வாழ்க்கை

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

Self Study Paper

Thiagarajar College (Autonomous) :: Madurai – 625 009
SELF STUDY PAPER
(For those joined UG on or after June 2019)

Course Code	Course Title	Category	L	T	P	Credit
U19SS51	**Soft Skills**	Self Study Paper	-	-	-	5

Year	Semester	Int. Marks	Ext.Marks	Total
Third	Fifth	----	100	100

*** Carries Extra 5 credits that do not form part mandatory credits (140) required for completion of the course. Optional paper not compulsory for all UG students.**

Preamble

Prepare the students to develop skills, provide training to face interview .prepare themselves with the right skill-sets and attitude

Course Outcomes

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

	Course outcomes	Knowledge Level
CO1	Possess a basic idea on the understanding of nature, cause, effect and ways to deal with critical challenges in everyday life	K1,K2
CO2	Overcome the aspects such as Communication barriers, Stress management, Emotions.	K3
CO3	Gain insights into high-in-demand soft skills and prepare themselves with the right skill-sets and attitude	K1,K2
CO4	Develop or take part inteam work, Thinking skills, Creativity and time management.	K3
CO5	Prepare themselves to face different levels of interviews. Develop skills to manage an organization	K3

K1: Knowledge K2: Understand K3: Apply

Blooms taxonomy: Assessment Pattern

	CA		End of Semester
	First	**Second**	
Knowledge	40%	40%	40%
Understand	40%	40%	40%
Apply	20%	20%	20%

Unit - 1

Self Awareness (Concept of Self-esteem, Positive and Negative self esteem) Motivation (Nature and types, Factors enhancing and affecting Motivation, Needs and Drives) (Creativity Introduction, Nature of Creativity, Stages of Creativity, Enhancing Creativity, Verbal and Non Verbal Creativity) Values and Ethics (Nature and Significance, Values, Ethics, Work Ethics, Character building, Manners and Ethics)

Self Management (Self management skills and Social Competency, Social Competency Behaviour, Value Orientation, Life goals)

Unit 2

Communication and Thinking Communication (Definition, Types, Styles, Culture and Communication); Thinking (Nature, Types, Problem Solving, Proactive thinking, Positive Thinking, Assertiveness)

Unit 3

Emotions (Nature of emotions, Emotional Intelligence and its strategies, Attachment, Love, Happiness, Introduction to Anger – Causes, Types, Functions and Consequences, Anger management)

Stress (Nature of stress, Relation between Demands and Coping, Types and Causes, Effects and Indicators, Management of Stress, Time management and Stress reduction) Empathy (Definition, Nature and Factors enhancing empathy)

Unit4

Excelling through a placement process(Resume writing; Taking a written test; Group discussion – Need, Types, Tips and techniques; Interview handling – Tips and Techniques)

Unit 5

Being effective in an organisation

50 rules of work, Professional Etiquettes and Mannerism, Building relationship within an organisation, Communication skills, Working in teams, Managing conflicts, Effective negotiation skills, Problem solving using creativity.

Text book

3. Life Skills for Success – AlkaWadkar – 2016 Edition SAGE | TEXTS Sagepublishing.com
4. Campus to Corporate – Roadmap to Employability – Gangadhar Joshi – 2015 Edition SAGE | TEXTS Sagepublishing.com

Reference textbook

3 ACE of Soft skills – Gopalaswamy Ramesh and Mahadevan Ramesh, Pearson Publication
4 Bridging the soft skills gap – Bruce Tulgan – 2015 Edition – Wiley Publication

B.Sc. Biotechnology (2019)

Assessment values of course learning outcomes and their mapping with program specific outcomes (PSOs)

Major papers

Title of the courses	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**
General Microbiology	7	9	9	8	9
General Microbiology lab 1	5	7	7	7	6
Analytical Biochemistry	7	8	8	9	7
Cell Biology	9	10	11	9	8
Cell Biology Practical	8	7	9	7	7
Biomolecules	6	7	9	8	7
Analytical Biochemistry& Biomolecules lab	5	6	8	7	5
Molecular Biology	9	8	13	9	8
Basics of Computers and Bioinformatics	10	9	13	9	7
Molecular biology & Basics of Computers and Bioinformatics lab	8	9	8	7	7
Genetics &Biostatistics	7	7	10	6	5
Immunology	8	7	7	7	8
Clinical Laboratory Technology	10	6	11	6	12
Immunology& Clinical laboratory technology lab	7	5	8	5	9
Physiology	7	7	9	9	7
Genetics and Biostatistics & Physiology lab	7	6	7	6	5
Genetic Engineering	8	9	7	8	10
Industrial Biotechnology	7	7	8	7	8
Marine Biotechnology	9	9	7	7	8
Genetic Engineering lab	6	7	5	7	6
Industrial Biotechnology lab	5	7	6	6	5
Marine Biotechnology lab	6	7	8	6	5
Applied Microbiology	8	7	10	7	8
Metabolic pathways	7	7	7	9	8
Infectious diseases	7	8	7	7	8
Plant Biotechnology	10	11	9	10	9
Animal Biotechnology	8	7	7	8	8
Environmental Biotechnology	8	7	7	8	8
Plant Biotechnology Practical	8	8	8	9	8
Animal Biotechnology Lab	8	6	6	7	8
Environmental Biotechnology lab	6	6	5	6	6
Genomics	7	8	8	9	9
Food Biotechnology	7	8	9	7	7
Biosafety&IPR	8	8	8	6	10
Biodiversity & conservation	7	7	7	10	7

NME / SBE papers

Title of the courses	PSO1	PSO2	PSO3	PSO4	PSO5
Environmental Studies					
Personality Development					
Food processing technology	5	5	9	5	9
Mushroom Technology	5	7	6	5	9
Organic farming	6	8	6	6	6
Plant Tissue Culture	6	6	6	6	7
Vocational Biotechnology	6	7	6	6	6
Value education					
Herbal medicine	6	6	6	7	7
Health & Hygiene	7	7	9	7	6
Microscopy & Microtechniques	8	9	7	8	8