



**THIAGARAJAR COLLEGE MADURAI - 625009**  
(An Autonomous Institution, affiliated to Madurai Kamaraj  
University)  
(Re-Accredited with 'A' Grade by NAAC)

# **Department of Botany & Biotechnology**

**B.Sc., Botany**

**M.Sc., Botany**

**M. Phil., Botany**

**B.Sc., Biotechnology**



# **B.Sc., Botany**

**THIAGARAJAR COLLEGE, MADURAI – 9.****(Re-Accredited with ‘A’ Grade by NAAC)****DEPARTMENT OF BOTANY****(For those who join in 2017 and after))****BACHELOR OF BOTANY****Semester – I**

| Course                 | Code No | Subject               | Hrs/Week  | Cred.     | Total Hrs | Max Mark CA | Max Marks SE | Total      |
|------------------------|---------|-----------------------|-----------|-----------|-----------|-------------|--------------|------------|
| Part I                 | P111    | Tamil                 | 6         | 3         | 90        | 25          | 75           | 100        |
| Part II                | P211    | English               | 6         | 3         | 90        | 25          | 75           | 100        |
| Core 1                 | MB11    | Plant Diversity I     | 6         | 6         | 90        | 25          | 75           | 100        |
| Core Lab 1             | MBL11   | Plant Diversity I Lab | 4         | 2         | 60        | 40          | 60           | 100        |
| Generic Elective1      | AZ11    | Economic Zoology      | 4         | 4         | 60        | 25          | 75           | 100        |
| Generic elective 1 lab | AZL11   | Economic Zoology Lab  | 2         | -         | 30        |             |              |            |
| AECC                   | ES      | EVS                   | 2         | 2         | 30        | 15          | 35           | 50         |
| <b>TOTAL</b>           |         |                       | <b>30</b> | <b>20</b> |           |             |              | <b>550</b> |

**Semester – II**

| Course                                   | Code No | Subject                 | Hrs/Week  | Cred      | Total Hrs | Max Mark CA | Max Marks SE | Total      |
|--|---------|-------------------------|-----------|-----------|-----------|-------------|--------------|------------|
| Part I                                   | P121    | Tamil                   | 6         | 3         | 90        | 25          | 75           | 100        |
| Part II                                  | P221    | English                 | 6         | 3         | 90        | 25          | 75           | 100        |
| Core 2                                   | MB21    | Plant Diversity II      | 6         | 6         | 90        | 25          | 75           | 100        |
| Core Lab 2                               | MBL21   | Plant Diversity II Lab  | 4         | 2         | 60        | 40          | 60           | 100        |
| Generic Elective2                        | AZ21    | Anc. Zoology            | 4         | 4         | 60        | 25          | 75           | 100        |
| Generic Elective2 Lab                    | AZL21   | Anc. Zoology Lab        | 2         | --        | 30        |             |              |            |
| Practical Examination for Allied Zoology |         |                         |           | 2         |           | 40          | 60           | 100        |
| AECC                                     | BAEC21  | Personality Development | 2         | 2         | 30        | 15          | 35           | 50         |
| <b>TOTAL</b>                             |         |                         | <b>30</b> | <b>22</b> |           |             |              | <b>650</b> |

### Semester – III

| Course                | Code No | Subject   | Hrs/Week  | Cred.     | Total Hrs | Max Mark CA | Max Marks SE | Total      |
|-----------------------|---------|---|-----------|-----------|-----------|-------------|--------------|------------|
| Part I                | P131    | Tamil   | 6         | 3         | 90        | 25          | 75           | 100        |
| Part II               | P231    | English   | 6         | 3         | 90        | 25          | 75           | 100        |
| Core 3                | MB31    | Microbiology and Plant Pathology                                  | 3         | 4         | 45        | 25          | 75           | 100        |
| Core 4                | MB32    | Cell biology and Plant Anatomy                                    | 3         | 4         | 45        | 25          | 75           | 100        |
| Core Lab 3            | MBL31   | Microbiology, Plant Pathology, Cell biology and Plant Anatomy Lab | 4         | 2         | 60        | 40          | 60           | 100        |
| Generic Elective3     | AC31    | Anc. Chemistry  | 4         | 4         | 60        | 25          | 75           | 100        |
| Generic Elective3 Lab | ACL41   | Anc. Chemistry Lab  | 2         | --        | 30        | -           | -            | -          |
| NME                   | BNME31  | Gardening   | 2         | 2         | 30        | 15          | 35           | 50         |
| <b>TOTAL</b>          |         |   | <b>30</b> | <b>22</b> |           |             |              | <b>650</b> |

### Semester – IV

| Course                                     | Code No | Subject  | Hrs/Week | Cred | Total Hrs | Max mark CA | Max Mark SE | Total |
|--|---------|--|----------|------|-----------|-------------|-------------|-------|
| Part I                                     | P141    | Tamil  | 6        | 3    | 90        | 25          | 75          | 100   |
| Part II                                    | P241    | English  | 6        | 3    | 90        | 25          | 75          | 100   |
| Core 5                                     | MB41    | Plant Embryology and Tissue Culture  | 3        | 4    | 45        | 25          | 75          | 100   |
| Core 6                                     | MB42    | Bioinstrumentation and Computer Applications                                       | 3        | 4    | 45        | 25          | 75          | 100   |
| Core Lab 4                                 | MBL41   | Plant Embryology, Tissue Culture, Bioinstrumentation and Computer Applications Lab | 4        | 2    | 60        | 40          | 60          | 100   |
| Generic Elective 4                         | AC41    | Chemistry  | 4        | 4    | 60        | 25          | 75          | 100   |
| Generic Elective4 Lab                      | ACL41   | Chemistry Lab  | 2        |      | 30        |             |             |       |
| Practical Examination for Allied Chemistry |         |  |          | 2    |           | 40          | 60          | 100   |
| SEC  | BSEC41  | SEC(A) Biofertilizers and Organic farming/<br>SEC(B) Histology and Staining        | 2        | 2    | 30        | 15          | 35          | 50    |

|              |  |                                     |           |           |  |  |  |            |
|--------------|--|-------------------------------------|-----------|-----------|--|--|--|------------|
|              |  | Techniques<br>SEC(C) Bioremediation |           |           |  |  |  |            |
| <b>Total</b> |  |                                     | <b>30</b> | <b>24</b> |  |  |  | <b>750</b> |

**Semester – V**

| Course       | Code No    | Subject   | Hrs/<br>Week | Cred<br>· | Total<br>Hrs | Max<br>Mark<br>CA | Max<br>Marks<br>SE | Total      |
|--------------|------------|---|--------------|-----------|--------------|-------------------|--------------------|------------|
| Core 7       | MB51       | Morphology and Taxonomy of Angiosperms  | 4            | 4         | 60           | 25                | 75                 | 100        |
| Core 8       | MB52       | Plant Biochemistry  | 4            | 4         | 60           | 25                | 75                 | 100        |
| Core 9       | MB53       | Genetics, Evolution and Biostatistics   | 3            | 4         | 45           | 25                | 75                 | 100        |
| Core Lab 5   | MBL51      | Morphology and Taxonomy of Angiosperms Lab  | 4            | 2         | 60           | 40                | 60                 | 100        |
| Core Lab 6   | MBL52      | Plant Biochemistry Lab  | 4            | 2         | 60           | 40                | 60                 | 100        |
| Core Lab 7   | MBL53      | Genetics, Evolution and Biostatistics Lab   | 2            | 1         | 30           | 40                | 60                 | 100        |
| M elective1  | EMB51      | EMB51(H) Horticulture and Plant Breeding/<br>EMB51(P) Plant Resources and Utilization | 5            | 5         | 75           | 25                | 75                 | 100        |
| NME          | BNME5<br>1 | Botanical World   | 2            | 2         | 30           | 15                | 35                 | 50         |
| VE           |            | Value Education   | 2            | 1         | 30           | 15                | 35                 | 50         |
| <b>Total</b> |            |   | <b>30</b>    | <b>25</b> |              |                   |                    | <b>800</b> |

**Semester – VI**

| Course                                     | Code No | Subject   | Hrs/<br>Week | Cred       | Total<br>Hrs               | Max<br>Mark<br>CA | Max<br>Marks<br>SE | Total      |
|--|---------|---|--------------|------------|----------------------------|-------------------|--------------------|------------|
| Core 10                                    | MB61    | Plant Physiology  | 4            | 5          | 60                         | 25                | 75                 | 100        |
| Core 11                                    | MB62    | Biotechnology   | 4            | 4          | 60                         | 25                | 75                 | 100        |
| Core 12                                    | MB63    | Plant Ecology and Biodiversity  | 4            | 4          | 60                         | 25                | 75                 | 100        |
| Core Lab 8                                 | MBL61   | Plant Physiology Lab  | 4            | 2          | 60                         | 40                | 60                 | 100        |
| Core Lab 9                                 | MBL62   | Biotechnology Lab   | 4            | 2          | 60                         | 40                | 60                 | 100        |
| Core Lab 10                                | MBL63   | Plant Ecology and Biodiversity Lab  | 4            | 2          | 60                         | 40                | 60                 | 100        |
| M Elective2                                | EMB61   | EMB61(B) Basics of Molecular Biology/<br>EMB61(N) Nutraceuticals                                      | 4            | 5          | 60                         | 25                | 75                 | 100        |
| SEC  | BSEC61  | SEC(D) Mushroom Technology/<br>SE(E) Seed and Nursery Technology<br>SEC(F) Food Processing Technology | 2            | 2          | 30                         | 15                | 35                 | 50         |
| <b>Part V</b>                              |         |   | -            | 1          |                            |                   |                    |            |
| <b>TOTAL</b>                               |         |   | <b>30</b>    | <b>27</b>  |                            |                   |                    | <b>750</b> |
| <b>TOTAL CREDITS FOR SEMESTERS I to VI</b> |         |   |              | <b>140</b> | <b>(20+22+22+24+25+27)</b> |                   |                    |            |

## 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

|          |                       |                                |
|----------|-----------------------|--------------------------------|
| 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<br>01 Credit    |
| Part V   |                       |                                |
|          | <b>Total</b>          | <b>140 Credits</b>             |



**Allied Botany (for B. Sc., Industrial Microbiology – Semester III and IV)**

| Course                                       | Code No. | Subject  | Contact Hrs/ Week | Credits | Total No. of Hrs Allotted | Max. Marks. CA | Max. Marks. SE | Total |
|--|----------|--|-------------------|---------|---------------------------|----------------|----------------|-------|
| <b>Semester - III</b>                        |          |  |                   |         |                           |                |                |       |
| Allied                                       | AB31 (P) | Plant Life forms and utilisation                         | 4                 | 4       | 60                        | 25             | 75             | 100   |
| Allied Lab                                   | ABL31    | Plant life forms and utilization lab                     | 2                 | -       | 30                        |                |                |       |
| <b>Semester - IV</b>                         |          |  |                   |         |                           |                |                |       |
| Allied                                       | AB41 (P) | Plant Pathology  | 4                 | 4       | 60                        | 25             | 75             | 100   |
| Allied Lab                                   | ABL41    | Plant Pathology Lab                                      | 2                 | -       | 30                        | -              | -              | -     |
| Practical Examination for AB31 (P) & AB41(P) |          | Plant life forms and Utilisation and Plant Pathology Lab | -                 | 2       |                           | 40             | 60             | 100   |

**Non- Major Elective offered by Botany Department**

| Course                | Code No. | Subject         | Contact Hrs/ Week | Credits | Total No. of Hrs Allotted | Max. Marks. CA | Max. Marks. SE | Total |
|-----------------------|----------|-----------------|-------------------|---------|---------------------------|----------------|----------------|-------|
| <b>Semester – III</b> |          |                 |                   |         |                           |                |                |       |
| Non Major Elective I  | NME1     | Gardening       | 2                 | 2       | 30                        | 15             | 35             | 50    |
| <b>Semester – V</b>   |          |                 |                   |         |                           |                |                |       |
| Non Major Elective II | NME2     | Botanical World | 2                 | 2       | 30                        | 15             | 35             | 50    |

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**DEPARTMENT OF BOTANY**  
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|                     |                           |            |       |
|---------------------|---------------------------|------------|-------|
| Course              | : B.Sc. Botany            | Int. Marks | : 25  |
| Class               | : I Year                  | Ext. Marks | : 75  |
| Semester            | : I                       | Max. Marks | : 100 |
| Sub. Code           | : MB11                    | Hours/Week | : 6   |
| Title of the Paper: | Plant Diversity I(Core 1) | Credits    | : 6   |

**Course Outcomes:**

On the successful completion of the course, students will be able to

- recognize the lower group of plants.
- explain the diversity and complexity of plant kingdom
- realize the significance of lower group of plants.

(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 and Life 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

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|                    |                                      |            |       |
|--------------------|--------------------------------------|------------|-------|
| Course             | :--B.Sc. Botany                      | Int. Marks | : 40  |
| Class              | : I Year                             | Ext. Marks | : 60  |
| Semester           | : I                                  | Max. Marks | : 100 |
| Sub. Code          | : MBL11                              | Hours/Week | : 4   |
| Title of the Paper | : Plant Diversity I Lab (Core Lab 1) | Credits    | : 2   |

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 gametophytic thallus, gametangium and tetrasporophytic thallus.
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.

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|---------------------|-----------------------------|------------|-------|
| Course              | : B.Sc. Botany              | Int. Marks | : 25  |
| Class               | : I Year                    | Ext. Marks | : 75  |
| Semester            | : II                        | Max. Marks | : 100 |
| Sub. Code           | : MB 21                     | Hours/Week | : 6   |
| Title of the Paper: | Plant Diversity II (Core 2) | Credits    | : 6   |

**Course Outcomes:**

On the successful completion of the course, students will be able to

- distinguish the first vascular plants and first flowering plants
- describe their diversity and complexity
- realize their significance

**Unit I:** General characteristic features of Pteridophytes. Smith Classification of Pteridophytes. General characteristic features of Psilopsida. *Psilotum* – habitat, distribution, external structure, internal structure and reproduction. General characteristic features of Lycopsidea. *Lycopodium* - external structure, internal structure, reproduction 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 features Gymnosperms. Classification of Gymnosperms by Sporne. 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.and Sinha,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

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|---------------------|------------------------------------|------------|-------|
| Course              | : B.Sc. Botany                     | Int. Marks | : 40  |
| Class               | : I Year                           | Ext. Marks | : 60  |
| Semester            | : II                               | Max. Marks | : 100 |
| Sub. Code           | : MBL 21                           | Hours/Week | : 4   |
| Title of the Paper: | Plant Diversity II Lab (Core Lab2) | Credits    | : 2   |

Study of morphology 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 of

10. Fossil types
11. *Rhynia* stem
12. *Lepidodendron*

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|---------------------|--------------------------------|------------|------|
| Course              | : B.Sc. Botany                 | Int. Marks | : 15 |
| Class               | : I                            | Ext. Marks | : 35 |
| Semester            | : II                           | Max. Marks | : 50 |
| Sub.Code            | : BAEC21                       | Hours/Week | : 2  |
| Title of the Paper: | <b>Personality Development</b> | Credits    | : 2  |

**Course Outcomes**

On the successful completion of the course, students will be able to

- understand the cause of a problem and way to solve it
- be acquainted with different and difficult situations

**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.

**Text books**

1. N.Chockan 2011 Learn to understand others, Prodigy books, Chennai
2. Machakkalai, R and L. Saraswathi 2005. Personality development a need. Mangai Publishers, Madurai

**Reference books**

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

Course designer

Dr.Jegathesan



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|---------------------|--|------------|-------|
| Course              | : B.Sc. Botany                                   | Int. Marks | : 25  |
| Class               | : II Year  | Ext. Marks | : 75  |
| Semester            | : III  | Max. Marks | : 100 |
| Sub. Code           | : MB31   | Hours/Week | : 3   |
| Title of the Paper: | <b>Microbiology and Plant Pathology (Core 3)</b> | Credits    | : 4   |

**Course Outcomes:**

On the successful completion of the course, students will be able to

- explain the classification, nutrition and growth of microbes.
- perform the basic techniques in microbial culture production
- identify the plant diseases and try to practice the control measures for such diseases.

**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- Genetic recombination in Bacteria - Conjugation, Transformation, Transduction (Brief account only). Virus -structure and replication-bacteriophage 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. Jayaram Paniker. 1996. Text book of Microbiology. Orient Longman, Hyderabad.
- 2) Aneja, K.R. 1996. Experiments in Microbiology, Plant pathology, Tissue culture and Mushroom Cultivation. Vishwa Prakashan (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.Sadhana**

**2. Dr. V.Karthikeyan**

**THIAGARAJAR COLLEGE, MADURAI – 9.**  
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**DEPARTMENT OF BOTANY**  
**(For those who join in 2017 and after))**

|                     |  |            |       |
|---------------------|--|------------|-------|
| Course              | : B.Sc. Botany                                 | Int. Marks | : 25  |
| Class               | : II Year                                      | Ext. Marks | : 75  |
| Semester            | : III  | Max. Marks | : 100 |
| Sub. Code           | : MB32   | Hours/Week | : 3   |
| Title of the Paper: | <b>Cell Biology and Plant Anatomy (Core 4)</b> | Credits    | : 4   |

**Course Outcomes:**

On the successful completion of the course, students will be able to

- depict the basic structure and organization of plants
- reveal the functions of different cell organelles and tissues

**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 polytene structures. 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. Secretary tissues. 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**

**Dr. K.Saraswathi**

**THIAGARAJAR COLLEGE, MADURAI – 9.**  
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**DEPARTMENT OF BOTANY**  
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|                     |   |            |          |
|---------------------|---|------------|----------|
| Course              | : B.Sc. Botany  | Int. Marks | : 40     |
| Class               | : II Year   | Ext. Marks | : 60     |
| Semester            | : III   | Max. Marks | : 100    |
| Sub. Code           | : MBL31   | Hours/Week | : 4(2+2) |
| Title of the Paper: | <b>Microbiology, Plant Pathology,<br/>Cell Biology and Plant Anatomy Lab (Core Lab 3)</b> | Credits    | : 2      |

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,air,etc.
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*

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|                     |   |            |       |
|---------------------|---|------------|-------|
| Course              | : B.Sc. Botany  | Int. Marks | : 25  |
| Class               | : II Year   | Ext. Marks | : 75  |
| Semester            | : IV  | Max. Marks | : 100 |
| Sub. Code           | : MB41  | Hours/Week | : 3   |
| Title of the Paper: | <b>Plant Embryology and Tissue Culture (Core 5) Credits</b> |            | : 4   |

**Course Outcomes:**

On successful completion of the course students will be able to

- To study about the fundamentals of plant embryology
- To understand the basic principles and techniques involved in plant tissue culture

**Unit I:** Flower: Essential and Nonessential parts-Sepals, Petals (non-essential), Androecium and 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 gametophyte, Structure and types of ovules.

**Unit II:** Pollination: Kinds of pollination (Self and Cross)- Fertilization: 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 media composition. 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, Somatic embryogenesis, process of somatic embryogenesis, Synthetic seeds – Applications.

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

**Test Books:**

1. Rahavan, V. 1976. Experimental Embryogenesis in vascular plants, Academic Press, London.
2. Maheswari, P. 1963. An Introduction to Embryology of Angiosperms, International Society of plant Morphologies, New Delhi.
3. Smith, R.H. 1992. Plant Tissue Culture. Techniques and experiments, Academic Press, Sandiego.
4. Dubey, R.C. 2001. A Text book of biotechnology, S chand & Co., New Delhi.
5. Kalyan kumar, D.E. 2008. Plant Tissue Culture, New Central Book Agency, Calcutta.

**Reference Books:**

1. Bhojwani, S.S and Razdan, M.K. 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, Sandiego.
4. Bhojwani, S.S and Dantu, P.K. 2013. Plant Tissue Culture; An Introductory Text, Springer, India.

**Course Designers:**

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

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|                     |  |             |       |
|---------------------|--|-------------|-------|
| Course              | : B.Sc. Botany   | Int. Marks  | : 25  |
| Class               | : II Year  | Ext. Marks  | : 75  |
| Semester            | : IV   | Max. Marks  | : 100 |
| Sub. Code           | : MB42   | Hours/Week: | 3     |
| Title of the Paper: | <b>Bioinstrumentation and Computer Applications (Core 6) Credits : 4</b> |             |       |

**Course Outcomes:**

On the successful completion of the course, students will be able to

- learn about the basic concepts, principles and standard operating procedures of instruments in biology.
- know the various application of instruments and techniques.
- understand the basic principles of computer, its components and applications in various fields of biology.

**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



## **Reference books**

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**

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|                    |   |            |          |
|--------------------|---|------------|----------|
| Course             | : B.Sc. Botany  | Int. Marks | : 40     |
| Class              | : II Year   | Ext. Marks | : 60     |
| Semester           | : IV  | Max. Marks | : 100    |
| Sub. Code          | : MBL41   | Hours/Week | : 4(2+2) |
| Title of the Paper | : <b>Plant Embryology, Plant tissue culture,<br/>Bioinstrumentation and Computer Applications</b> | Credits    | : 2      |

**Plant Embryology and Plant Tissue Culture Practicals**

1. Preparation of Murashige and Skoog medium
2. Explants Preparation
3. Callus induction in tobacco leaf disc, regeneration of shoots, root induction, role of hormones 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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|                    |   |            |      |
|--------------------|---|------------|------|
| Course             | : B.Sc. Botany  | Int. Marks | : 15 |
| Class              | : II Year   | Ext. Marks | : 35 |
| Semester           | : IV  | Max. Marks | : 50 |
| Sub. Code          | : BSEC41(A)   | Hours/Week | : 2  |
| Title of the Paper | : <b>Biofertilizers and Organic Farming</b><br>(Skill Based Elective) | Credits    | : 2  |

**Course Outcomes:**

On the successful completion of the course, students will be able to

- Isolate, identify and mass multiply biofertilizers
- Explain the benefits of organic farming

**Unit I: Biofertilizers:** Introduction and scope. A general account of Biofertilizers organisms - Algae (BGA), Bacteria and Mycorrhizae. Mass cultivation of *Azolla*. Bacteria – Rhizobium and its mass production. Phosphate solubilizing bacterial biofertilizers - *Pseudomonas* and 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, Ipswitch, UK.
4. Palaniappan SP & Anandurai K. 1999. Organic Farming – Theory and Practice. Scientific Publications

**Reference Books:**

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

**Course Designers:**

**Dr. K.Rajendran**

**THIAGARAJAR COLLEGE, MADURAI – 9.**  
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|                    |  |            |      |
|--------------------|--|------------|------|
| Course             | : B.Sc. Botany   | Int. Marks | : 15 |
| Class              | : II Year  | Ext. Marks | : 35 |
| Semester           | : IV   | Max. Marks | : 50 |
| Sub. Code          | : BSEC41(B)  | Hours/Week | : 2  |
| Title of the Paper | : <b>Histology and Staining Techniques</b><br>(Skill Based Elective) | Credits    | : 2  |

**Course Outcomes:**

On the successful completion of the course, students will be able to

- study the nature of cell and tissue types.
- acquire knowledge about microscopes and microtomes.
- understand the principles of different staining techniques.

**Unit-I:** Histology-Introduction- histological classification of cells, types of plant tissues-simple and 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:**

1. Prasad, M.K. and Prasad M.Krishna. 1975. Outlines of Microtechniques, Emkay publications. Delhi.
2. Periyasamy, K. 1980. Histochemistry, developmental and structural anatomy of angiosperms: a symposium, P & B publications, Tiruchirapalli.

**Reference Books:**

1. 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.
2. Clark, G.1981. Staining Procedures, Fourth edition, Baltimore: Williams & Wilkins, ISBN 0683017071.
3. Histological techniques: Microtomy; <http://www.histologicaltechniques>.

**Course designers**

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

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|                     |  |            |      |
|---------------------|--|------------|------|
| Course              | : B. Sc Botany                               | Int. Marks | : 15 |
| Class               | : II Year                                    | Ext. Marks | : 35 |
| Semester            | : IV   | Max. Marks | : 50 |
| Sub. Code           | : BSEC41(C)                                  | Hours/Week | : 2  |
| Title of the Paper: | <b>Bioremediation</b> (Skill Based Elective) | Credits    | : 2  |

**Course Outcomes:**

On the successful completion of the course, students will be able to

- demonstrate the causes and factors influencing xenobiotics in the environment
- explain the principles of bioremediation

**Unit I:** Introduction to pollution - Pollutants-types –effects on environment- recalcitrant compounds 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: *In situ* methods and *Ex situ* remediation methods. Bioleaching – copper and gold. Bioremediation of xenobiotics – reductive degradation, oxidative degradation, hydrolysis. Bioremediation of hydrocarbons – bioremediation of heavy metals

**Text books:**

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

**Reference books:**

1. Gupta, P.K.1994. Elements of Biotechnology, Rastogi and Co., Meerut, India.
2. 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

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|                    |  |            |       |
|--------------------|--|------------|-------|
| Course             | : B.Sc. Botany   | Int. Marks | : 25  |
| Class              | : III Year   | Ext. Marks | : 75  |
| Semester           | : V  | Max. Marks | : 100 |
| Sub. Code          | : MB51   | Hours/Week | : 4   |
| Title of the Paper | : <b>Morphology and Taxonomy of Angiosperms (Core 7)</b> Credits : 4 |            |       |

**Course Outcomes:**

On the successful completion of the course, students will be able to

- classify angiosperms and to get acquainted with the local flora.
- describe the principles of Systematics.

**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 – 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. Annonaceae 2. Capparidaceae 3. Rutaceae 4. Caesalpiniaceae 5. 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 Monocotyledons 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. Columbia Uni. Press. New York.
4. Stace, C.A. 1980. Plant Taxonomy and Biosystematics, Edward Arnold Publishing Limited, London. 874

**Course designers:**

**Dr.K.Rajendran**

**Dr. R.Aruna**

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|---------------------|---|------------|-------|
| Course              | : B.Sc. Botany                                    | Int. Marks | : 40  |
| Class               | : III Year  | Ext. Marks | : 60  |
| Semester            | : V   | Max. Marks | : 100 |
| Sub. Code           | : MBL51   | Hours/Week | : 4   |
| Title of the Paper: | <b>Morphology and Taxonomy of Angiosperms Lab</b> | Credits    | : 2   |
|                     | (Core Lab 5)                                      |            |       |

Root, Stem and leaf modification of Angiosperms

Study on the morphological and floral characters of the following families using Gamble flora

|                 |                |                |
|-----------------|----------------|----------------|
| Annonaceae      | Sapotaceae     | Amaranthaceae  |
| Capparidaceae   | Convolvulaceae | Euphorbiaceae  |
| Rutaceae        | Asclepiadaceae | Amaryllidaceae |
| Caesalpiniaceae | Acanthaceae    | Poaceae        |
| Cucurbitaceae   | Lamiaceae      | Cyperaceae     |

Field trip for Preparation of Herbarium (10 sheets)



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|--------------------|--------------------------------------|------------|-------|
| Course             | : B.Sc. Botany                       | Int. Marks | : 25  |
| Class              | : III Year                           | Ext. Marks | : 75  |
| Semester           | : V                                  | Max. Marks | : 100 |
| Sub. Code          | : MB52                               | Hours/Week | : 4   |
| Title of the Paper | : <b>Plant Biochemistry</b> (Core 8) | Credits    | : 4   |

**Course Outcomes:**

On the successful completion of the course, students will be able to

- describe the structural details, types and properties of bio-molecules
- depict the metabolism of amino acids and lipids
- explain the nomenclature, mechanism of enzyme activity

**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 Bio-chemical 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 and functions

**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:**

1. 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, 2<sup>nd</sup> 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              | : B. Sc Botany                             | Int. Marks | : 40  |
| Class               | : III Year                                 | Ext. Marks | : 60  |
| Semester            | : V  | Max. Marks | : 100 |
| Sub. Code           | : MBL52                                    | Hours/Week | : 4   |
| Title of the Paper: | <b>Plant Biochemistry Lab</b> (Core Lab 6) | Credits    | : 2   |

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)

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**DEPARTMENT OF BOTANY**  
**(For those who join in 2017 and after))**

|                     |   |            |             |
|---------------------|---|------------|-------------|
| Course              | : B. Sc Botany  | Int. Marks | : 25        |
| Class               | : III Year  | Ext. Marks | : 75        |
| Semester            | : V   | Max. Marks | : 100       |
| Sub. Code           | : MB53  | Hours/Week | : 3         |
| Title of the Paper: | <b>Genetics, Evolution and Biostatistics (Core 9)</b> |            | Credits : 4 |

**Course Outcomes:**

On successful completion of the course students will be able to

- To study about the principles and applications of plant genetics
- To study the basic concept and theories on evolution
- To learn the basics of data collection and analysis by statistical methods

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

**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 *Lathyrus odoratus* – Theories – Chiasma type – breakage first – differential contraction – Limiting factors of crossing over – significance; Polygenic inheritance – Kernel colour 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 *Chlamydomonas reinhardtii* ; 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 – Table forms – 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:**

1. Archunan. 2004. Genetics, Sarup & Sons, New Delhi.
2. Shukla, R.N. 2009. A Text Book of Genetics and Evolution, Daya Publishing House, New Delhi.

3. Arora, M.P. Arora, H. 2013, A Text Book of Organic Evolution, Daya Publishing House, New Delhi.
4. Sharma, A.K.2005. Text Book of Biostatistics, Discovery Publishing House, New Delhi.

**Reference Books:**

1. Ringo, J. 2004. Fundamental Genetics, Cambridge University Press.
2. Barton, N.H. 2007. Evolution, Cold Spring Harbor Laboratory Press, New York.
3. Ridley, M.2009. Evolution, John Wiley Sons, USA.
4. Zar, J.H. 2010. Biostatistical Analysis, Prantice – Hall Inc.

**Course Designer:**

**Dr.E.Mohan**

**THIAGARAJAR COLLEGE, MADURAI – 9.**  
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**DEPARTMENT OF BOTANY**  
**(For those who join in 2017 and after))**

|  |                |            |       |
|--|----------------|------------|-------|
| Course   | : B. Sc Botany | Int. Marks | : 40  |
| Class  | : III Year     | Ext. Marks | : 60  |
| Semester   | : V            | Max. Marks | : 100 |
| Sub. Code  | : MBL53        | Hours/Week | : 2   |
| Title of the Paper: <b>Genetics, Evolution and Biostatistics Lab</b> (CoreLab 7) |                | Credits    | : 1   |

**I** Problems solving in the following topics:

1. Mendelian Monohybrid ratio
2. Mendelian Dihybrid ratio
3. Monohybrid reciprocal cross, back cross and test cross
4. Gene Interaction – Duplicatory genes, Supplementary genes, Dominant epistasis, Recessive epistasis

**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) *Albizia* pods

**III** Models/Spotters – Relevant to theory topics

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|                     |  |            |       |
|---------------------|--|------------|-------|
| Course              | : B. Sc Botany                         | Int. Marks | : 25  |
| Class               | : III Year                             | Ext. Marks | : 75  |
| Semester            | : V                                    | Max. Marks | : 100 |
| Sub. Code           | : EMB51(A)                             | Hours/Week | : 5   |
| Title of the Paper: | <b>Horticulture and Plant Breeding</b> | Credits    | : 5   |
|                     | (Core Elective)                        |            |       |

**Course Outcomes:**

On successful completion of the course students will be able to

- understand the basic notion of Horticulture
- learn the techniques of propagation, gardening and flower arrangement
- know the concepts of plant breeding

**Unit I:** Importance of horticulture – Classification of horticultural crops – Garden implements – 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 – Dry flower 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:**

1. Chandha, K.L.2001. Hand book of Horticulture, New Delhi.
2. Rao, K.M. 1991. Text Book of horticulture, Mac Millan India Ltd, New Delhi.
3. Vishnu Swarup, 1999. Ornamental horticulture, Mac Millan India Ltd, New Delhi.
4. Sadhu, M.K.1996. Plant propagation. New age international publisher, New Delhi.
5. Sinha, V and Suinta sinha, 1990. Cytogenetics, Plant breeding and Evolution, Vikas publishing Home Pvt Ltd.

**Reference Books:**

1. Adariana, F.R.W. and Brison. 1979. Propagation of Horticultural crops. Tata Mc Graw-Hill Publishing Company Ltd, New Delhi.

2. Acquaah, G. 1999. Horticulture, Principles and Practices, Prentice Hall, New Jersey.
3. Prasad and Kumar, U.2005. Commercial Floriculture. Agrobios (India), Jodhpur.
4. Pohelman, J.M and Borthakur, D.1969. Breeding Asian field crops, Oxford and IBH publishing Co, New Delhi.

**Course Designer:**  
**Dr.E.Mohan**



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|                     |  |            |       |
|---------------------|--|------------|-------|
| Course              | : B. Sc Botany   | Int. Marks | : 25  |
| Class               | : III Year   | Ext. Marks | : 75  |
| Semester            | : V  | Max. Marks | : 100 |
| Sub. Code           | : EMB51(B)   | Hours/Week | : 5   |
| Title of the Paper: | <b>Plant Resources and Utilization</b> (Core Elective) | Credits    | : 5   |

**Course Outcomes:**

On the successful completion of the course, students will be able to

- Know the economically important groups of plants
- Study the morphology and useful parts commonly used plants
- Acquire knowledge about the medicinal plants

**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:** Morphology, useful parts and uses of the following: Food plants: *Oryza sativa* (Rice), *Triticum aestivum* (Wheat), *Vigna mungo* (Black gram), *Glycine max* (Soybean), *Prunus dulcis* (Almonds), *Cocos nucifera* (Coconut), *Manihot esculenta* (Tapioca), *Solanum tuberosum* (Potato), *Brassica oleracea* (Cabbage), *Solanum lycopersicum* (Tomato), *Mangifera indica* (Mango) and *Musa paradisiaca* (Banana) Beverages: *Coffea arabica* (Coffee) and *Camellia sinensis* (Tea) Spices and Condiments: *Zingiber officinale* (Ginger) and *Cuminum cyminum* (Cumin)

**Unit III:** Morphology, useful parts and uses of the following: Fibre and fibre yielding plants: *Gossypium hirsutum* (Cotton) and *Corchorus capsularis* (Jute), *Musa textilis* (Abaca Manila Hemp). 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: *Albizia lebbek* (Vagai), *Cassia alata* (Seemai Agathi), *Acacia leucocephloea* (Sarai) and *Lawsonia inermis* (Maruthani) Gums and Resins: *Acacia senegal* (Sudday keeray), *Moringa oleifera* (Murungai), *Shorea robusta* (Sal) and *Pinus roxburghii* (Chir), Lac and shellac.

**Unit IV:** Morphology, useful parts and uses of the following: Plantation crops: *Casuarina equisetifolia* (Sea oak) and *Hevea brasiliensis* (Rubber). Medicinal Plants: *Allium cepa* (Onion), *Cinnamomum zeylanicum* (Cinnamon), *Ocimum tenuiflorum* (Holy Basil), *Piper nigrum* (Pepper), *Curcuma longa*, (Turmeric) and *Azadirachta indica* (Neem).

**Unit V:** Morphology, useful parts and uses of the following: Oil yielding plants: *Helianthus annuus* (Sunflower), *Sesamum indicum* (Sesame), *Ricinus communis* (Castor), *Borassus flabellifer* (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 e-book. <http://trove.nla.gov.au/version/46518552>

**Course Designer:**

**Dr.R.Aruna**

**THIAGARAJAR COLLEGE, MADURAI – 9.**  
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|                     |                                   |            |       |
|---------------------|-----------------------------------|------------|-------|
| Course              | : B. Sc Botany                    | Int. Marks | : 25  |
| Class               | : III Year                        | Ext. Marks | : 75  |
| Semester            | : VI                              | Max. Marks | : 100 |
| Sub. Code           | : MB61                            | Hours/Week | : 4   |
| Title of the Paper: | <b>Plant Physiology</b> (Core 10) | Credits    | : 5   |

**Course Outcomes:**

On the successful completion of the course, students will be able to

- understand the concepts of water uptake and movement in plants
- learn with the knowledge on plant nutrition and solute translocation
- study the photobiology and plant cellular metabolism – photosynthesis and respiration in plants
- understand the physiological concepts of the growth and flowering
- study the functional roles of plant growth regulators in plants growth and physiology

**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 – Advantages of Transpiration.

**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.

**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

**Unit IV:** Respiratory Metabolism – Respiratory quotient (RQ) Aerobic respiration – Glycolysis – TCA cycle – Oxidative Phosphorylation – 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

**Unit V:** Plant Growth Regulators – auxins, gibberellins, cytokinins, abscissic acid and ethylene- general 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 - methods of breaking seed dormancy- mechanism of seed germination; Vernalization: Definition, mechanism and significance. Nyctinasty plant movements – Phototropism, thigmotropism and diurnal plant movements

**Text Books:**

1. Gupta, N. K. and S. Gupta. 2005. 'Plant Physiology', Oxford & IBH publishing Co. Ltd., New Delhi
2. Dutta, K. 'Plant Physiology', 2000. Narosa Publishers, New Delhi.
3. Noggle, G. R. and G. J. Fritz. Introductory Plant Physiology, Second Edition, Prentice-Hall of India Ltd., New Delhi.
4. Srivastava, L.M. 2010. 'Plant Growth and Development: Hormones and Environment', Academic Press, California.

**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.

**Course Designer:**

**Dr. D. Kannan**

**THIAGARAJAR COLLEGE, MADURAI – 9.**  
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**DEPARTMENT OF BOTANY**  
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|                     |                                |            |       |
|---------------------|--------------------------------|------------|-------|
| Course              | : B. Sc Botany                 | Int. Marks | : 25  |
| Class               | : III Year                     | Ext. Marks | : 75  |
| Semester            | : VI                           | Max. Marks | : 100 |
| Sub. Code           | : MB62                         | Hours/Week | : 4   |
| Title of the Paper: | <b>Biotechnology</b> (Core 11) | Credits    | : 4   |

**Course Outcomes:**

On the successful completion of the course, students will be able to

- enlighten the students on the basic principles of biotechnological innovations
- understand genetic engineering techniques
- study about the industrial applications of biotechnology

**Unit I:** Biotechnology-introduction and application in various fields. Genetic engineering tools: restriction endo nuclease, DNA ligase, reverse 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 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.

**Reference books:**

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

**Course designers**

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

**THIAGARAJAR COLLEGE, MADURAI – 9.**  
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|                     |   |            |       |
|---------------------|---|------------|-------|
| Course              | : B.Sc. Botany                          | Int. Marks | : 25  |
| Class               | : III Year                              | Ext. Marks | : 75  |
| Semester            | : VI                                    | Max. Marks | : 100 |
| Sub. Code           | : MB 63                                 | Hours/Week | : 4   |
| Title of the Paper: | Plant Ecology and Biodiversity (Core 2) | Credits    | : 4   |

**Course Outcomes:**

On the successful completion of the course, students will be able to

- Comprehend the components and their interaction in an ecosystem.
- acquire the values of biodiversity
- explore the methods of conservation of nature

**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**

**THIAGARAJAR COLLEGE, MADURAI – 9.**  
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**DEPARTMENT OF BOTANY**  
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|                    |  |            |       |
|--------------------|--|------------|-------|
| Course             | : B.Sc. Botany                             | Int. Marks | : 40  |
| Class              | : III Year                                 | Ext. Marks | : 60  |
| Semester           | : VI                                       | Max. Marks | : 100 |
| Sub. Code          | : MBL61                                    | Hours/Week | : 4   |
| Title of the Paper | : <b>Plant Physiology Lab</b> (Core Lab 6) | Credits    | : 2   |

**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 *Acalypha indica* plant

**II) Demonstration**

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

**III. Spotters using specimens/models/photographs with relevance to the theory syllabus**



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|                     |                                       |            |       |
|---------------------|---------------------------------------|------------|-------|
| Course              | : B.Sc., Botany                       | Int. Marks | : 40  |
| Class               | : III Year                            | Ext. Marks | : 60  |
| Semester            | : VI                                  | Max. Marks | : 100 |
| Sub. Code           | : MBL62                               | Hours/Week | : 4   |
| Title of the Paper: | <b>Biotechnology Lab (Core Lab 9)</b> | Credits    | : 2   |

1. Isolation of genomic DNA from Onion/Cauliflower
2. Demonstration of wine fermentation – estimation of ethanol
3. Yeast biomass estimation by turbidity method
4. Cell counting using haemocytometer
5. Immobilization of yeast cell
6. *Spirulina* culturing
7. Agar production using *Gracilaria*
8. Antibiotic disc diffusion using cultures of *Penicillium* and actinomycetes
9. Citric acid production using *Aspergillus niger*
10. Amylase production using fungi (Plate assay)
11. Replica plating method for identifying antibiotic resistant mutants
12. Explant preparation from explants
13. Callus induction from *Datura*/carrot explants

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|                    |   |            |             |
|--------------------|---|------------|-------------|
| Course             | : B.Sc. Botany  | Int. Marks | : 40        |
| Class              | : III Year  | Ext. Marks | : 60        |
| Semester           | : VI  | Max. Marks | : 100       |
| Sub. Code          | : MBL63   | Hours/Week | : 4         |
| Title of the Paper | : <b>Plant Ecology and Biodiversity Lab (Core Lab9)</b> |            | Credits : 2 |

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<sub>2</sub> in the given water sample.
5. Determination of chlorides in the water sample.
6. Determination of primary productivity
7. Determination of soil organic carbon
8. Determination of soil nitrogen
9. Determination of BOD
10. Study of anatomical variations of plants in polluted environment
11. Study of morphology and anatomy of hydrophytes: *Nymphaea* petiole
12. Study of morphology and anatomy of xerophytes: *Eichornia* stem

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|                     |                                    |            |       |
|---------------------|------------------------------------|------------|-------|
| Course              | : B.Sc., Botany                    | Int. Marks | : 25  |
| Class               | : III Year                         | Ext. Marks | : 75  |
| Semester            | : VI                               | Max. Marks | : 100 |
| Sub. Code           | : EMB61                            | Hours/Week | : 4   |
| Title of the Paper: | <b>Basics of Molecular Biology</b> | Credits    | : 5   |
|                     | (Core Elective 2)                  |            |       |

**Course Outcomes:**

On the successful completion of the course, students will be able to

- understand the mechanism of replication
- explain errors during replication and repair mechanisms
- explain the mechanism of protein synthesis

**Unit I:** DNA Replication - general principles and types - bidirectional replication, Semiconservative, Semidiscontinuous. Various models of DNA replication - rolling circle, D3loop (mitochondrial),  $\Theta$  (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 and mechanisms

**Unit III:** Mechanism of Transcription - RNA Polymerase and the transcription unit  
Transcription 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 3 ribosome 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:**

1. Freifelder, D. Molecular Biology.
2. Verma, P S., 2006. Cell Biology Genetics Molecular Biology Evolution And Ecology. S.Chand and Co., New Delhi.
3. Singh, B.D., 1998. Biotechnology. Kalyani publishers, New Delhi.

**Reference books:**

1. Sheeler, P. and D.E. Binachi 2004. Cell & Molecular Biology, John Wile & Sons, New York
2. Geoffrey M. Cooper, Robert, E. Hansman. 2007. The cell – A Molecular Approach, Sinauer Associates. USA
- 3 Gupta, P.K.1994. Elements of Biotechnology, Rastogi and Co., Meerut, India.

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

**THIAGARAJAR COLLEGE, MADURAI – 9.**  
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**DEPARTMENT OF BOTANY**  
**(For those who join in 2017 and after))**

|                     |   |            |       |
|---------------------|---|------------|-------|
| Course              | : B.Sc., Botany                         | Int. Marks | : 25  |
| Class               | : III Year                              | Ext. Marks | : 75  |
| Semester            | : VI                                    | Max. Marks | : 100 |
| Sub. Code           | : EMB61 (B)                             | Hours/Week | : 4   |
| Title of the Paper: | <b>Nutraceuticals</b> (Core Elective 2) | Credits    | : 5   |

**Course Outcomes:**

On the successful completion of the course, students will be able to

- explain about the concepts and importance of Nutraceuticals
- depict about the nutrients importance and pharmaceutical values of Nutraceuticals

**Unit I:** Introduction to Nutraceutical Industry, classification of nutraceuticals, dietary supplements, fortified foods, functional foods and phytonutraceuticals. Scope involved in the Industry, Indian and global scenario

**Unit II:** Nutraceuticals of plant and animal origin, Plant secondary metabolites, -Alkaloids, phenols, Terpenoids. Nutraceutical applications of Greens, cereals, pulses, nuts and diary. Role of medicinal and aromatic plants in nutraceutical industry propagation.

**Unit III:** Nutrition related diseases and disorders. Carbohydrates, Protein and Fat - Excess and deficiency disorders. Role of nutraceuticals in the prevention and treatment with special reference to diabetes mellitus and hypertension. Diabetic rice.

**Unit IV:** Concept, Biochemistry of nutrition and dietetics Balanced Diet, Food Pyramid, Nutritional Assessment of Carbohydrates, Proteins. Nutritional Requirements in daily diet. Introduction to nanobiotechnology with special reference to nutraceuticals.

**Unit V:** Microbial and algal nutraceuticals, Concept of prebiotics and probiotics - principle, mechanism, production and applications of prebiotics and probiotics. Biotechnology in Phytonutraceuticals.

**Text book:**

1. Geoffrey P. Webb. 2006. Dietary supplements and functional foods. Blackwell Publishing.
2. Lusso, JN. 2007. Angi-angiogenic functional and medicinal foods. CRC Press.

**Reference Books :**

1. Cupp, J and Tracy, TS.2003. Dietary supplements: Toxicology and Clinical Pharmacology. Humana Press.
2. Manson, P.2001. Dietary supplements (2nd Ed) Pharmaceutical Press.
3. Campbell, JE and Summers, JL. 2004. Dietary Supplement Labeling Compliance .
4. Shi, J.2007. Functional Food Ingredients and Nutraceuticals: Processing Technologies. Taylor & Francis Publ. CRC Press.
5. Goldberg, I 1994. Functional Foods: Designer Foods, Pharma foods, Nutraceuticals Chapman & Hall.

6. Robert E.C. 2006. Handbook of Nutraceuticals and Functional Foods. 2<sup>nd</sup> Ed. Wildman.
7. Brigelius-Flohé, J and Joost, HG. 2006. Nutritional Genomics: Impact on Health and Disease. Wiley-VCH
8. Neeser, JR and German, BJ. 2004. Bioprocesses and Biotechnology for Functional Foods and Nutraceuticals. Marcel Dekker.

### **Course designers**

#### **1. Dr. V.Karthikeyan**

**THIAGARAJAR COLLEGE, MADURAI – 9.**  
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|                    |  |            |      |
|--------------------|--|------------|------|
| Course             | : B.Sc. Botany   | Int. Marks | : 15 |
| Class              | : III Year   | Ext. Marks | : 35 |
| Semester           | : VI   | Max. Marks | : 50 |
| Sub. Code          | : BSEC62 (D)   | Hours/Week | : 2  |
| Title of the Paper | : <b>Mushroom Technology</b><br>(Skill Based Elective) | Credits    | : 2  |

**Course Outcomes:**

On the successful completion of the course, students will be able to

- cultivate mushroom cultivation.
- explain the nutritive and medicinal value of mushrooms.
- depict the common cultivation methods for mushrooms.

**Unit I:** Mushrooms-Introduction-Types of mushrooms: Edible, non-edible mushrooms and medicinal 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, Wishwa Prakashan, 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.

**Course designer:**

**Dr. R.Aruna**

**THIAGARAJAR COLLEGE, MADURAI – 9.**  
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|                     |   |            |      |
|---------------------|---|------------|------|
| Course              | : B.Sc., Botany   | Int. Marks | : 15 |
| Class               | : III Year  | Ext. Marks | : 35 |
| Semester            | : VI  | Max. Marks | : 50 |
| Sub. Code           | : BSEC62 (E)  | Hours/Week | : 2  |
| Title of the Paper: | <b>Food Processing Technology</b><br>(Skill based Elective) | Credits    | : 2  |

**Course Outcomes:**

On the successful completion of the course, students will be able to

- understand the classification of various foods and its importance in human nutrition.
- know the basic knowledge of food ingredients and its calorific values
- acquire information about food processing techniques.

**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:**

1. Patrica Trueman, 2007. *Nutritional Biochemistry*, MJP Publishers.
2. Shankuntala Manay, N. and M.Shadaksharaswamy, 2014. *Foods-Facts and Principles*. 3<sup>rd</sup> Edn. New Age, International (P) Limited Publishers.

**Reference Books:**

1. William C Frazier, Dennis C Westhoff, Adapted by N.M.Vanitha, 2014. Mc Graw Hill Education(India) Private Limited, New Delhi.
2. Journal of Beverage and food world- Nov, 2008, vol.30,33 and 35.

**Course designers**

1. Dr.B.Sadhana
2. Dr. V.Karthikeyan

**THIAGARAJAR COLLEGE, MADURAI – 9.**  
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|                     |  |            |      |
|---------------------|--|------------|------|
| Course              | : B.Sc., Botany  | Int. Marks | : 15 |
| Class               | : III Year   | Ext. Marks | : 35 |
| Semester            | : VI   | Max. Marks | : 50 |
| Sub. Code           | : BSEC62 (F)   | Hours/Week | : 2  |
| Title of the Paper: | <b>Seed and Nursery Technology</b><br>(Skill Based Elective) | Credits    | : 2  |

**Course Outcomes:**

On the successful completion of the course, students will be able to

- Learn about the basics of seed technology
- Know the various techniques involved in Nursery construction

**Unit – I:** Seed, Definition, structure of monocot and dicot seed, Type of seeds, seed collection, 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**



# **Allied papers**

## **(Generic Elective)**

**THIAGARAJAR COLLEGE, MADURAI – 9.**  
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**DEPARTMENT OF BOTANY**  
**(For those who join in 2017 and after))**

|                     |   |            |       |
|---------------------|---|------------|-------|
| Course              | : B.Sc., Microbiology                   | Int. Marks | : 25  |
| Class               | : I Year                                | Ext. Marks | : 75  |
| Semester            | : I                                     | Max. Marks | : 100 |
| Sub. Code           | : AB31                                  | Hours/Week | : 4   |
| Title of the Paper: | <b>Plant Life Forms and Utilization</b> | Credits    | : 4   |

**Course Outcomes:**

On the successful completion of the course, students will be able to

- understand the general characters of plant groups
- know about the botanical name and utility values of plants and their parts
- develop the knowledge in plant-animal interaction in certain useful products
- motivate the students to develop entrepreneurial skills

**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 economic importance (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 their difference – 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: Nymphaeaceae, 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, brief detail 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:**

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

**Reference Books:**

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

**Course Designer:**

**Dr. D. Kannan**

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|                     |   |            |       |
|---------------------|---|------------|-------|
| Course              | : B.Sc., MB                               | Int. Marks | : 25  |
| Class               | : I Year                                  | Ext. Marks | : 75  |
| Semester            | : II                                      | Max. Marks | : 100 |
| Sub. Code           | : AB41(P)                                 | Hours/Week | : 4   |
| Title of the Paper: | <b>PLANT PATHOLOGY</b> (Generic Elective) | Credits    | : 4   |

**Course Outcomes:**

On the successful completion of the course, students will be able to

- study the plant diseases with special reference to southern India.
- understand the diseases, symptoms, causal organisms – etiology of the diseases and control measures

**Unit I:** Plant pathology Introduction, history, Concept, Importance, diagnosis and classification Inoculum, penetration, infection, invasion, and dispersal – plant defense mechanism (enzymes, and toxins).

**Unit II:** Epidemiology: forms, reasons of progressive severity of epidemics and decline of epidemics. Recent methods of plant disease forecasting. Concepts of post harvest disease management.

**Unit III:** Symptomatology Study of the following diseases, symptom manifestation and control measures. 1. Citrus canker 2. Tikka disease of groundnut 3. Cucumber Mosaic virus 4. Smut of Sorghum 5. Red rot of Sugar cane

**Unit IV:** Symptomatology Study of the following diseases 1. *Cordylobia anthropophaga*, the mango fly 2. Cabbageworm, 3. Hairy caterpillar *Eupterote mollifera* of Drumstick 4. Aphids and worms of Ladies finger plant 5. Stem borer of rice

**Unit V:** Plant disease control Concepts– plant quarantine principles. Eradication – crop rotation, field sanitation, soil treatment and seed treatments. Management strategies: physical chemical, and biological. Engineered resistance against fungal, viral and bacterial pathogens.

**Text Books :**

1. Mehrotra. R.S. 1980. Plant pathology. Tata McGraw Hill, New Delhi.
2. Rangaswamy, G. 1975. Diseases of crop plants in India. 2nd Edn. Prentice Hall, India

**Reference Books :**

1. Bilgrami, K.S. and Dube, H.C. 1976. A text book of modern plant pathology. Vikas Publishing House Pvt. Ltd., New Delhi.

2. Pandey B.P. 1989. A text book of plant pathology, pathogen and plant diseases. S. Chand and Company Ltd., New Delhi.
3. Mukerji, K.G. & Bhasin, J. 1972. Plant diseases of India – A source book. Tata McGraw Hill, New Delhi.

**Course designer**

**1. Dr. V.Karthikeyan**

**THIAGARAJAR COLLEGE, MADURAI – 9.**  
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|                     |   |            |       |
|---------------------|---|------------|-------|
| Course              | : B.Sc., IMB  | Int. Marks | : 40  |
| Class               | : I   | Ext. Marks | : 60  |
| Semester            | : I & II  | Max. Marks | : 100 |
| Sub. Code           | : ABL31 & ABL41   | Hours/Week | : 2+2 |
| Title of the Paper: | <b>Plant Life Forms and Utilization<br/>and Plant Pathology Lab</b> | Credits    | : 2   |

Plant Life Forms and Utilization experiments (III Semester)

1. *Gracelaria* - 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 *Rhynia major* stem, using permanent slide
8. Morphological and floral characteristic study using plant specimens, on the following families: Nymphaeaceae, 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)

1. Isolation of microbes from food samples, soil and air.
2. Isolation of bacteriophages 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.

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|                     |                                       |            |      |
|---------------------|---------------------------------------|------------|------|
| Course              | : UG                                  | Int. Marks | : 15 |
| Class               | : II year                             | Ext. Marks | : 35 |
| Semester            | : III                                 | Max. Marks | : 50 |
| Sub. Code           | :BNME31                               | Hours/Week | : 2  |
| Title of the Paper: | <b>Gardening</b> (Non Major Elective) | Credits    | : 2  |

**Course outcomes:**

On the successful completion of the course, students will be able to

- acquire knowledge about different components of home garden.
- learn about Indoor garden, Bonsai and Kitchen garden.
- imbibe knowledge about fresh flower arrangement, dry flower preparation techniques and arrangement and greeting card making.

**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>

**Course designer**

**1. Dr. R.Aruna**

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|                     |   |            |      |
|---------------------|---|------------|------|
| Course              | : UG  | Int. Marks | : 15 |
| Class               | : III year                                  | Ext. Marks | : 35 |
| Semester            | : V   | Max. Marks | : 50 |
| Sub. Code           | :BNME51                                     | Hours/Week | : 2  |
| Title of the Paper: | <b>Botanical World</b> (Non Major Elective) | Credits    | : 2  |

**Course Outcomes:**

On the successful completion of the course, students will be able to

- acquire the basic knowledge of plants
- recognize the role of plants in day-to-day life

**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



**THIAGARAJAR COLLEGE, MADURAI – 9.**  
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|   |                |            |       |
|---|----------------|------------|-------|
| Course  | : B.Sc. Botany | Int. Marks | : 25  |
| Class   | : I Year       | Ext. Marks | : 75  |
| Semester  | : I and II     | Max. Marks | : 100 |
| Sub. Code   | : <b>CB1</b>   | Hours/Week | : 2   |
| Title of the Paper: <b>Biopesticides (Certificate course)</b> |                |            |       |

**Course Outcomes:**

On the successful completion of the course, students will be able to

- understand the principles of biological control
- know about various bio-control agents.

**Unit I:** Types of Plant pests: Insects & Nematodes, Biopesticides: Introduction, importance and classification. Biological control of Insect pests: Scope and principles, factors affecting biological control— living creatures to control pests—Biological control of weeds.

**Unit II:** Botanical principles: Present status and future prospects; opportunities for botanical pesticides in crop rotation; multiple cropping for controlling pests. Plants as a source of natural pesticides: Mustard, Chrysanthemum, Pepper, Garlic, Turmeric and Citronella.

**Unit III:** Biocontrol agents: Isolation, identification, mode of action and mass production of *Pseudomonas fluorescense* (bacterial agent), *Trichoderma viride* (fungal agent); application against seed borne and soil borne diseases.

**Unit IV:** Biological Pesticides: Isolation, identification, Bacterium as biopesticide: *Bacillus thuringiensis*; Fungus as biopesticide (entomophagous); *Beauveria bassiana* and *Arthrotrichum*. Insect as biopesticide: *Trichogramma*. Virus as biopesticide: Baculovirus: NPV.

**Unit V:** Production methods of biopesticides: Liquid culture fermentation – Types of biopesticide formulations; Dry inoculum, Granules, Pellets, Capsules, Wettable powder and liquid formulations. Genetic engineering and pest resistant plants (outline only).

**Text Books:**

1. Ghosh, G.K. 2000. Biopesticide and Integrated pest management, APH Publishing corporation, New Delhi.
2. Subba Rao, N.S. 1982. Advances in Agricultural Microbiology, Oxford & IBH Publishing Company, Chennai.

**Reference Books:**

1. Hell, F.R. and Menn, J.J. 1999. Biopesticides – Use and delivery, Humene Press, New Jersey.
2. Dent, D. 2000. Insect Pest Management, Second Edition, ABI Publishers, UK.

**Course Designers**

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

# **M.Sc., Botany**

**THIAGARAJAR COLLEGE, MADURAI – 9.**  
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**DEPARTMENT OF BOTANY**  
**(For those who join in 2017 and after))**

**MASTER OF SCIENCE IN BOTANY**  
**COURSE STRUCTURE**  
**SEMESTER –I**

| Course       | Code No. | Subject   | Contact Hrs/ Week | Credits   | Total No. of hours allotted | Max. Marks |            | Total      |
|--------------|----------|---|-------------------|-----------|-----------------------------|------------|------------|------------|
|              |          |   |                   |           |                             | CA         | SE         |            |
| Core - 1     | 1PB1     | Thallophytes, Bryophytes, Pteridophytes and Gymnosperms     | 6                 | 5         | 90                          | 25         | 75         | 100        |
| Core - 2     | 1PB2     | Plant Cell and Molecular Biology                            | 6                 | 5         | 90                          | 25         | 75         | 100        |
| Elective - 1 | 1PBE1    | Developmental Botany  | 6                 | 5         | 90                          | 25         | 75         | 100        |
| Core Lab- 1  | 1PBL1    | Thallophytes, Bryophytes, Pteridophytes and Gymnosperms Lab | 6                 | 4         | 90                          | 40         | 60         | 100        |
| Core Lab- 2  | 1PBL2    | Plant Cell and Molecular Biology Lab                        | 6                 | 4         | 90                          | 40         | 60         | 100        |
|              |          | <b>Total</b>  | <b>30</b>         | <b>23</b> | <b>450</b>                  | <b>155</b> | <b>345</b> | <b>500</b> |

**SEMESTER –II**

| Course       | Code No. | Subject  | Contact Hrs/ Week | Credits   | Total No. of hours allotted | Max. Marks |            | Total      |
|--------------|----------|--|-------------------|-----------|-----------------------------|------------|------------|------------|
|              |          |  |                   |           |                             | CA         | SE         |            |
| Core - 3     | 2PB1     | Plant Biochemistry and Biotechniques               | 6                 | 5         | 90                          | 25         | 75         | 100        |
| Core - 4     | 2PB2     | Microbiology and Plant Pathology                   | 6                 | 5         | 90                          | 25         | 75         | 100        |
| Elective - 2 | 2PBE1    | Computer Applications in Biology and Biostatistics | 6                 | 5         | 90                          | 25         | 75         | 100        |
| Core Lab- 3  | 2PBL1    | Plant Biochemistry and Biotechniques Lab           | 6                 | 4         | 90                          | 40         | 60         | 100        |
| Core Lab- 4  | 2PBL2    | Microbiology and Plant Pathology Lab               | 6                 | 4         | 90                          | 40         | 60         | 100        |
|              |          | <b>Total</b>                                       | <b>30</b>         | <b>23</b> | <b>450</b>                  | <b>155</b> | <b>345</b> | <b>500</b> |

### SEMESTER –III

| Course       | Code No. | Subject                                  | Contact Hrs/ Week | Credits   | Total No. of hours allotted | Max. Marks |            | Total      |
|--------------|----------|--|-------------------|-----------|-----------------------------|------------|------------|------------|
|              |          |  |                   |           |                             | CA         | SE         |            |
| Core - 5     | 3PB1     | Angiosperm Taxonomy                      | 6                 | 5         | 90                          | 25         | 75         | 100        |
| Core - 6     | 3PB2     | Plant Physiology                         | 6                 | 5         | 90                          | 25         | 75         | 100        |
| Elective - 3 | 3PZE1    | Interdisciplinary paper: Applied Zoology | 6                 | 5         | 90                          | 25         | 75         | 100        |
| Core Lab- 5  | 3PBL1    | Angiosperm Taxonomy lab                  | 6                 | 4         | 90                          | 40         | 60         | 100        |
| Core Lab- 6  | 3PBL2    | Plant Physiology lab                     | 6                 | 4         | 90                          | 40         | 60         | 100        |
|              |          | <b>Total</b>                             | <b>30</b>         | <b>23</b> | <b>450</b>                  | <b>155</b> | <b>345</b> | <b>500</b> |

### SEMESTER –IV

| Course      | Code No. | Subject                                      | Contact Hrs/ Week | Credits   | Total No. of hours allotted | Max. Marks |            | Total      |
|-------------|----------|--|-------------------|-----------|-----------------------------|------------|------------|------------|
|             |          |  |                   |           |                             | CA         | SE         |            |
| Core - 7    | 4PB1     | Plant Biotechnology                          | 6                 | 5         | 90                          | 25         | 75         | 100        |
| Core - 8    | 4PB2     | Plant Ecology, Environment and Evolution     | 6                 | 5         | 90                          | 25         | 75         | 100        |
| Core Lab- 7 | 4PBL1    | Plant Biotechnology lab                      | 6                 | 4         | 90                          | 40         | 60         | 100        |
| Core Lab- 8 | 4PBL2    | Plant Ecology, Environment and Evolution lab | 6                 | 4         | 90                          | 40         | 60         | 100        |
| PJ          | PJ       | Project                                      | 6                 | 3         | 90                          | 40         | 40+20      | 100        |
|             |          | <b>Total</b>                                 | <b>30</b>         | <b>23</b> | <b>450</b>                  | <b>155</b> | <b>345</b> | <b>500</b> |

#### **Interdisciplinary paper : Applied Zoology offered by Dept. of Zoology**

**Theory:** Internal: 25 Marks [Assignment 5 marks; Seminar 15 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 paper: offered by the Department of Botany to M. Sc., Zoology students** Semester III: \*Plant Tissue Culture

#### **A) 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        |
| <b>Total</b> | <b>120</b> | <b>90</b> |

**B) Curriculum Credits**

Core ----- 75 Credits

Elective ----- 15 Credits

Total 90 Credits

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|                     |   |            |       |
|---------------------|---|------------|-------|
| Course              | : M.Sc. Botany  | Int. Marks | : 25  |
| Class               | : I Year  | Ext. Marks | : 75  |
| Semester            | : I   | Max. Marks | : 100 |
| Sub. Code           | : 1PB1  | Hours/Week | : 6   |
| Title of the Paper: | <b>Thallophytes, Bryophytes, Pteridophytes<br/>and Gymnosperms (Core 1)</b> | Credits    | : 5   |

**Course Outcomes:**

On the successful completion of the course, students will be able to

- elucidate the phylogenetic sequence of plant groups
- reveal their economic significance  
realize their ecological adaptations, internal organization and reproductive specialization

**Unit I:** Classification of algae by Chapman and Chapman (1973) – General Characters of the following divisions: Cyanophyta, Chlorophyta, Phaeophyta and Rhodophyta – Various habitats of algae - Freshwater, Marine and Soil - Range of thallus construction in 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 of Hepaticopsida, Anthocertopsida and Bryopsida. Range of gametophytes and sporophytes in Bryophytes. Economic importance of Bryophytes.

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

**Unit V:** Classification of Gymnosperms by Sporne (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 – Bryophyta, S. Chand & Co., New Delhi.
6. Chandrakant Pathak 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**

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|                     |  |            |       |
|---------------------|--|------------|-------|
| Course              | : M.Sc. Botany                                   | Int. Marks | : 25  |
| Class               | : I Year   | Ext. Marks | : 75  |
| Semester            | : I  | Max. Marks | : 100 |
| Sub. Code           | : 1PB2   | Hours/Week | : 6   |
| Title of the Paper: | <b>Plant Cell and Molecular Biology (Core 2)</b> | Credits    | : 5   |

**Course Outcomes:**

On the successful completion of the course, students will be able to

- explain the structure of organelles
- identify the special types of chromosomes
- describe the patten of regulation gene expression in prokaryotes and eukaryotes

**Unit I:** Microscopy – light, phase contrast microscopy, TEM, SEM, Flourescent and Confocal Microscopy. Cell: Ultra structure of plant cell. Cell wall: Primary structure – secondary structure. Plasma membrane: Fluid Mosaic model-properties. Cytosol: cytoskeleton organisation. Cell organelles: – mitochondria – plastids – endoplasmic reticulum – Golgi complex, peroxisomes, ribosome.

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

**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 – SOS response.

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

**Unit V:** Regulation of gene expression in Eukaryotes – mechanism of regulation – role of 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., New Delhi.
2. Verma, P S., 2006. Cell Biology Genetics Molecular Biology Evolution And Ecology. S.Chand and Co., New Delhi.



3. Singh, B. D., 2004. Genetics, Kalyani Publishers, New Delhi.
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, New Delhi.

**Course Designers:**

- 1. Dr. K.Jegatheesan**
- 2. Dr. M.Viji**

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|---------------------|--|------------|-------|
| Course              | : M.Sc. Botany                           | Int. Marks | : 25  |
| Class               | : I Year                                 | Ext. Marks | : 75  |
| Semester            | : I                                      | Max. Marks | : 100 |
| Sub. Code           | : 1PBE1                                  | Hours/Week | : 6   |
| Title of the Paper: | <b>Developmental Botany</b> (Elective 1) | Credits    | : 5   |

**Course Outcomes:**

On the successful completion of the course, students will be able to

- Have a clear idea of developmental process in plants
- Learn morphogenesis and organogenesis in plants
- Have a better understanding on fertilization and post-fertilization processes
- Have enriched knowledge on the fruit, seed, embryo and endosperm development

**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 apical meristem – 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; Ruminant 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 and Biochemical 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:**

1. Maheswari, P. 1985. An Introduction to the Embryology of the Angiosperm, Tata McGraw-Hill Publishing Company, New Delhi.
2. Burgess, J. 1985. An Introduction to Experimental and Applied Embryology of Angiosperms, Oxford and IBH Publishing Company, New Delhi.

3. Bhojwani, S.S. and Bhatnagar, S.P. 1992. The Embryology of Angiosperms, Vikas Publishing Housing Pvt. Ltd., New Delhi.

**Reference Books:**

1. Wardlaw, C.W. 1955. Embryogenesis in plants, Methuen and Company Ltd, London.
2. Swamy, B.G.L. and Krishnamurthy, K.V. 1980. From Flower to Fruit, McGraw-Hill Publishing Company, New Delhi.
3. Wareing, P.F. Philips, I.D.J. 1981. Growth and Differentiation in plants, Pergamon Press, Kidlington.
4. Wolpert, L. 2002. Principles of Development, Second Edition, Oxford University Press, New Delhi.

**Course Designers:**

1. Dr. D. Kannan
2. Dr. B. Sadhana

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|                     |  |            |       |
|---------------------|--|------------|-------|
| Course              | : M.Sc. Botany   | Int. Marks | : 40  |
| Class               | : I Year   | Ext. Marks | : 60  |
| Semester            | : I  | Max. Marks | : 100 |
| Sub. Code           | : 1PBL1  | Hours/Week | : 6   |
| Title of the Paper: | <b>Thallophytes, Bryophytes, Pteridophytes<br/>and Gymnosperms Lab (Core Lab1)</b> | Credits    | : 4   |

1. Limnological study of the aquatic and terrestrial microalgae of temple tank, pond and lake.
2. Study of the structure of *Oscillatoria*, *Spirulina*, *Nostoc*, *Anabaena*, *Microcystis* and *Scytonema*.
3. Study of the structure of *Tolypothrix*, *Westiellopsis*, *Cylindrospermum*, *Chlorella* and *Diatoms*.
4. Study of the external and internal structure of macroscopic seaweeds – *Ulva*, *Caulerpa*, *Padina*, *Sargassum*, *Gracilaria*.
5. Isolation and identification of fungi from bread, pickle, soil, seed and dung.
6. Identification and micropreparation of *Rhizopus*, *Mucor*, *Pilobolus*, *Aspergillus*, *Penicillium* and *Trichoderma*.
7. Identification and micropreparation of *Fusarium*, *Curvularia*, *Alternaria*, *Agaricus*, *Polyporus* and *Peziza*.
8. Study of the structure of Crustose, Foliose and Fruticose lichen thallus.
9. Study of the external and internal structure of *Marchantia*, *Porella* and *Pellia*.
10. Study of sporophyte and gametophyte structures of *Funaria*.
11. Study of the 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 Fossil slides of Psilophytales and Lepidodendrales
17. Study of fossil slides of Sphenophyllales and Coenopteridales
18. Study of internal structure of *Araucaria* stem.
19. Study of internal structure of *Cupressus* stem.
20. Study of internal structure of *Podocarpus* stem.
21. Study of fossil slides of *Lyginopteris*, *Lagenostoma* and *Medullosa*.

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|---|----------------|------------|-------|
| Course  | : M.Sc. Botany | Int. Marks | : 40  |
| Class   | : I Year       | Ext. Marks | : 60  |
| Semester  | : I            | Max. Marks | : 100 |
| Sub. Code   | : 1PBL2        | Hours/Week | : 6   |
| Title of the Paper: <b>Plant Cell and Molecular Biology Lab(core Lab 3)</b> |                | Credits    | : 4   |

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.

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|---------------------|--|------------|-------|
| Course              | : M.Sc. Botany                                       | Int. Marks | : 25  |
| Class               | : I Year   | Ext. Marks | : 75  |
| Semester            | : II   | Max. Marks | : 100 |
| Sub. Code           | : 2PB1   | Hours/Week | : 6   |
| Title of the Paper: | <b>Plant Biochemistry and Biotechniques (core 3)</b> | Credits    | : 5   |

**Course Outcomes:**

On the successful completion of the course, students will be able to

- describe the structure & function of the Biomolecules.
- understand the basic principles of Biotechniques.
- apply Biotechniques to biological systems.

**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 – amino acid 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-Menten constant- Lineweaver-Burk plot-Factors affecting enzyme action-enzyme inhibition – enzyme regulation – allosteric enzymes – isoenzymes – coenzymes – ribozymes. Vitamins: general characters, classification, vitamins with coenzyme function: NAD, NADP, FMN, FAD. Pigments:Structure and function of photosynthetic and non-photosynthetic pigments - 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 -  $\beta$  -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:

1. Centrifugation - Ultracentrifuges: preparative and analytical- types of rotors
2. pH metry
3. Spectrophotometry: UV-Visible – IR Spectrophotometry
4. Chromatograpy: Gas-liquid chromatography (GLC) and High performance (pressure) liquid chromatography (HPLC).

- Unit V:**
1. Electrophoresis: Agarose, PAGE and immunotechniques (ELISA)
  2. Blotting: Southern blot and Western blot
  3. Flow Cytometry
  4. 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:**

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

**Course Designers:**

1. Dr.K.Jegatheesan
2. Dr.E.Mohan

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|---------------------|--|------------|-------|
| Course              | : M.Sc. Botany                                   | Int. Marks | : 25  |
| Class               | : I Year   | Ext. Marks | : 75  |
| Semester            | : II   | Max. Marks | : 100 |
| Sub. Code           | : 2PB2   | Hours/Week | : 6   |
| Title of the Paper: | <b>Microbiology and Plant Pathology (core 4)</b> | Credits    | : 5   |

**Course outcomes:**

On the successful completion of the course, students will be able to

- classify the microbes according to their basic features
- do the culture of microbes from natural sources.
- assess the development of plant disease, host – pathogen interaction and the reasons for an epidemic disease.
- imbibe the knowledge of different control methods of plant diseases and etiology of some plant diseases

**Unit I:** Brief history of microbiology, General account of microbes, Archaeobacteria, Eubacteria and cyanobacteria. Prokaryotic and eukaryotic microbes, Whitaker’s five kingdom concept - Classification (Bergey’s manual of systematic Bacteriology). Bacteria: Ultra structure of bacteria-binary fission. Viruses: general structure-classification-transmission-multiplication: T<sub>4</sub>-bacteriophage, TMV and CMV.

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

**Unit III:** Soil microbiology: Microbial interactions-Mutualism, Commensalism, Parasitism and symbiosis. Microbial associations: Neutral, negative. Microbial fermentations - food contamination and its preservation. Aquatic 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:**

1. Prescott, L.M. and D.A.Harkey. 1996. Microbiology. Ww. C. Brown Publishers, London.
2. Pommerville, J.C.2006. Alcoma|| s Fundamantals of Microbiology. Jones and Bertlett Publishers, London.
3. Atlas, R.M.1995. Principles of Microbiology. Morby Publishers, St. Louis.
4. Pelczer,M.,E.C.S.Chan nad N.R.Krieg.1993.Microbiology-concepts and Applications. Tata Mc-Graw Hill Ltd., Inc., NewYork.
5. Stanier, R.Y., J.L.Ingrahm, M.L. Wheelis and P.R. Painter.1990. The Microbial World, Prentice Hall of India Pvt. Ltd. New Delhi.
6. Mehrotra, R.S.1980. Plant Pathology. Tata McGraw-Hill Publishing Company Ltd., New Delhi.
7. Pandey, B.R.1997. Plant Pathology. S. Chand and company, New Delhi.
8. Agrios,G.N. 2006. Plant Pathology, Fifth Edition, Academic Press, New York.
9. Detection and diagnosis of plant diseases. M.L. Gullinio, spinger, 2014

**Reference Books:**

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

**Course designers**

1. Dr. B. Sadhana
2. Dr. V.Karthikeyan

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|---------------------|---|------------|-------|
| Course              | : M.Sc. Botany  | Int. Marks | : 25  |
| Class               | : I Year  | Ext. Marks | : 75  |
| Semester            | : II  | Max. Marks | : 100 |
| Sub. Code           | : 2PBE1   | Hours/Week | : 6   |
| Title of the Paper: | <b>Computer Applications in Biology and Biostatistics</b> | Credits    | : 5   |
|                     | <b>(Elective -2)</b>                                      |            |       |

**Course Outcomes:**

On the successful completion of the course, students will be able to

- Have the practical knowledge on bioinformatics
- Apply the tools and programmes of bioinformatics in their research
- Practice statistical principles and to apply correlation, regression and ANOVA procedures, using computational methods viz., MS-EXCEL and SPSS-PC
- Have the clear understanding on probability distribution
- Acquire talents and skills on basics and advance level computational biostatistics to their research projects

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

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

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

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

**Text 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. Chiranjib Chakraborty. 2010. Bioinformatics: Approaches & Applications, Daya Publishing, New Delhi.
4. Khan, I.D. and Khanum, A. 2004. Fundamentals of Biostatistics, Ukasz Publications, Hyderabad, India, 2004

**Reference Books:**

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

**Course Designers:**

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

**THIAGARAJAR COLLEGE, MADURAI – 9.**  
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**DEPARTMENT OF BOTANY**  
**(For those who join in 2017 and after))**

|                     |   |            |             |
|---------------------|---|------------|-------------|
| Course              | : M.Sc. Botany  | Int. Marks | : 40        |
| Class               | : I Year  | Ext. Marks | : 60        |
| Semester            | : II  | Max. Marks | : 100       |
| Sub. Code           | : 2PBL1   | Hours/Week | : 6         |
| Title of the Paper: | <b>Plant Biochemistry and Biotechniques Lab (core Lab3)</b> |            | Credits : 4 |

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

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|                     |  |            |       |
|---------------------|--|------------|-------|
| Course              | : M.Sc. Botany   | Int. Marks | : 40  |
| Class               | : I Year   | Ext. Marks | : 60  |
| Semester            | : II   | Max. Marks | : 100 |
| Sub. Code           | : 2PBL2  | Hours/Week | : 6   |
| Title of the Paper: | <b>Microbiology and Plant Pathology Lab(core Lab4)</b> | Credits    | : 4   |

1. Preparation of media and pure culture technique.
2. Staining methods: Acid fast staining, Gram staining, Negative staining, Endospore staining and Staining of poly- $\beta$  hydroxyl butyrate granules.
3. Motility of bacteria-Hanging drop method.
4. Determining bacterial growth-turbidometric and haemocytometer method.
5. Bacterial analysis of water-coliform test- presumptive, confirmative and completed test.
6. Microbial production of extra cellular enzymes-Amylase and catalase.
7. Dye reduction test for milk.
8. Isolation of bacteriophages from sewage.
9. Isolation of *Rhizobium* and *Frankia* from the nodules.
10. Isolation of plant pathogens from infected plant materials.
11. Isolation of AM spores by wet sieving-decanting method.
12. 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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|                     |                                     |            |       |
|---------------------|-------------------------------------|------------|-------|
| Course              | : M.Sc. Botany                      | Int. Marks | : 25  |
| Class               | : II Year                           | Ext. Marks | : 75  |
| Semester            | : III                               | Max. Marks | : 100 |
| Sub. Code           | : 3PB1                              | Hours/Week | : 6   |
| Title of the Paper: | <b>Angiosperm Taxonomy (Core 5)</b> | Credits    | : 5   |

**Course Outcomes:**

On the successful completion of the course, students will be able to

- understand the taxonomic principles and to understand the different systems of plant classification
- learn the method of using flora and keys for the correct identification of plants
- develop skill in plant identification using specific morphology and floral characters

**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 families and economic importance of the following families, grouped under Polypetalae of dicotyledons: Magnoliaceae, Nymphaeaceae, Capparidaceae, Sterculiaceae, Sapindaceae, Zygophyllaceae, Rhamnaceae, Combretaceae, Aizoaceae, Passifloraceae

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

**Unit V:** 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, Loranthaceae, Euphorbiaceae, Typhaceae, Commeliniaceae, Araceae, Cyperaceae

**Text Books:**

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

**Reference Books/Research Articles:**

1. Simpson, M.G. 2006. Plant Systematics, Academic Press, UK.
2. Pulliah, T. 2007. Taxonomy of Angiosperms, Third Edition, Regency Publication, New Delhi
3. Johri, R.M. 2005. Taxonomy, Vol. I to V, Sonali Publication, New Delhi.
4. Battacharyya, B. 2005. Systematic Botany, Narosa Publishing House, New Delhi
5. 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 the Linnean Society*, **161** (2): 105–121, doi:10.1111/j.1095-8339.2009.00996

**Course Designers:**

1. Dr.E.Mohan
2. Dr.R.Aruna

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**DEPARTMENT OF BOTANY**  
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|                     |   |            |       |
|---------------------|---|------------|-------|
| Course              | : M.Sc. Botany                              | Int. Marks | : 40  |
| Class               | : II  | Ext. Marks | : 60  |
| Semester            | : III                                       | Max. Marks | : 100 |
| Sub. Code           | : 3PBL1                                     | Hours/Week | : 6   |
| Title of the Paper: | <b>Angiosperm Taxonomy Lab (Core Lab 5)</b> | Credits    | : 4   |

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

Plants belong to Polypetalae of Dicots: Magnoliaceae, Nymphaeaceae, Brassicaceae, Sterculiaceae, Sapindaceae, Zygophyllaceae, Rhamnaceae, Combretaceae, Aizoaceae, Passifloraceae

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

Plants belong to Monochlamydeae of Dicots, and Moncots: Nyctaginaceae, Piperaceae, Loranthaceae, Euphorbiaceae, Typhaceae, Commeliniaceae, Araceae, Cyperaceae

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 Gamble'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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|  |                |            |       |
|--|----------------|------------|-------|
| Course   | : M.Sc. Botany | Int. Marks | : 25  |
| Class  | : II           | Ext. Marks | : 75  |
| Semester   | : III          | Max. Marks | : 100 |
| Sub. Code  | : 3PB2         | Hours/Week | : 6   |
| Title of the Paper: <b>Plant Physiology (Core 6)</b> |                | Credits    | :     |
| 5  |                |            |       |

**Course outcomes:**

Upon successful completion of the course the students will be able

- define the physiological metabolic processes in plants.
- explain the role of hormones for plant growth.
- Depict the interaction and functioning of various organelles.
- do the functional behaviors of plant growth under different environments.

**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 C<sub>3</sub>, C<sub>4</sub> 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, Cytokinins, 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.

**Reference Books:**

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:****Dr. B. Sadhana**

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Course : M.Sc. Botany  
Class : II  
Semester : III  
Sub. Code : 3PBL2

Int. Marks : 40  
Ext. Marks : 60  
Max. Marks : 100  
Hours/Week : 6

Title of the Paper: **Plant Physiology Lab (Core Lab 6)**  
4

Credits :

1. Water potential by gravimetric method.
2. Water potential by falling drop method.
3. Osmotic potential by plasmolytic method.
4. Quantitative estimation of total chlorophyll content in leaves.
5. Quantitative estimation of carotenoid content in flowers
6. Absorption spectrum of chlorophylls and Action spectrum of Photosynthesis
7. Absorption spectrum of  $\beta$  – carotene.
8. Effect of temperature on membrane permeability
9. Effect on detergent on membrane permeability
10. Estimation of proline content in normal and senescent leaves
11. Determination of nitrogen content in roots and root nodules
12. Measurement of Stomatal Index
13. Measurement of Stomatal area
14. Mesophyll cell isolation and chlorophyll fluorescence
15. UV-B effect on nitrate reductase activity (Stress activity)
16. Differentiation of C<sub>3</sub> and C<sub>4</sub> plants by starch test.

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|                    |                                       |            |       |
|--------------------|---------------------------------------|------------|-------|
| Course             | : M.Sc. Botany                        | Int. Marks | : 25  |
| Class              | : II                                  | Ext. Marks | : 75  |
| Semester           | : IV                                  | Max. Marks | : 100 |
| Sub. Code          | : 4PB1                                | Hours/Week | : 6   |
| Title of the Paper | : <b>Plant Biotechnology (Core 7)</b> | Credits    | : 5   |

**Course Outcomes:**

**On Successful completion of the course the students will be to**

- Perform the techniques involved in plant genetic engineering
- explain the transgenic plants and plant tissue culture experiments
- apply the knowledge of biotechnology in exploitation of plants for human welfare

**Unit I: Genetic Engineering:** Scope, applications and limitations. Tools: Type-I, II and III Restriction Endonucleases, Modification Methylases, Alkaline phosphatases, Ligases, Reverse 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 enzymes- Amylases and proteases. Production of Antibiotics- Penicillin, Streptomycin. Bacterial biomass- *Lactobacillus*, *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  
5. publishers, Chennai
6. Singh,R. 2011. —Plant Biology and Biotechnology|| , Educational Publishers and Distributors, New Delhi.
7. Smith , R. H . 2000 —Plant Tissue Culture - Techniques and Experiments|| , Academic Press, New York.
8. Trivedi, P.C. 2010. —Plant Tissue Culture and Biotechnology|| , Second Edition, Pointer Publication, Jaipur. 915
9. Rana, S.V.S. 2012. —Biotechnology-Theory and practical|| , Third Edition, Elective Press, 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.

**Course Designers:**

1. Dr. K.Rajendran
2. Dr. K. Jegatheesan
3. Dr. V. Karthikeyan
4. Dr. M. Viji

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|                     |  |            |       |
|---------------------|--|------------|-------|
| Course              | : M.Sc. Botany   | Int. Marks | : 25  |
| Class               | : II Year  | Ext. Marks | : 75  |
| Semester            | : IV   | Max. Marks | : 100 |
| Sub. Code           | : 4PB2   | Hours/Week | : 6   |
| Title of the Paper: | <b>Plant Ecology, Environment and Evolution (Core 8)</b> | Credits    | : 5   |

**Course Outcomes:**

On the successful completion of the course, students will be able

- to have the clear understanding of ecology and environmental concepts.
- undertake the ecological conservation
- perform analytical methods in environmental and biodiversity management
- equip on the methods to adapt in sustainable environmental management related research and development

**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 growth curves – 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 secondary pollutants - 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**

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|                     |   |            |       |
|---------------------|---|------------|-------|
| Course              | : M.Sc. Botany                              | Int. Marks | : 40  |
| Class               | : II Year                                   | Ext. Marks | : 60  |
| Semester            | : IV  | Max. Marks | : 100 |
| Sub. Code           | : 4PBL1                                     | Hours/Week | : 6   |
| Title of the Paper: | <b>Plant Biotechnology Lab (Core Lab 8)</b> | Credits    | : 4   |

1. Fermentation by Yeast – Estimation of alcohol content.
2. Citric acid production by *Aspergillus niger* – 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 of and 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



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|  |                |            |       |
|--|----------------|------------|-------|
| Course   | : M.Sc. Botany | Int. Marks | : 40  |
| Class  | : II Year      | Ext. Marks | : 60  |
| Semester   | : IV           | Max. Marks | : 100 |
| Sub. Code  | : 4PBL2        | Hours/Week | : 6   |
| Title of the Paper: <b>Plant Ecology, Environment and Evolution Lab</b> ( Core Lab8)Credits: 4 |                |            |       |

1. Water analysis: Salinity, Alkalinity, BOD, COD, DO and free CO<sub>2</sub>.
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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|---------------------|--|------------|-------|
| Course              | : M.Sc. Zoology  | Int. Marks | : 25  |
| Class               | : II Year  | Ext. Marks | : 75  |
| Semester            | : III  | Max. Marks | : 100 |
| Sub. Code           | : 3PZE1  | Hours/Week | : 6   |
| Title of the Paper: | <b>Plant Tissue Culture (Interdisciplinary paper)</b><br><b>(offered to M.Sc., Zoology Students)</b> | Credits    | : 5   |

**Course Outcome**

On successful completion of the course students will be able to

- familiar with the basic principles and techniques in tissue culture
- know about the various techniques employed in plant tissue culture

**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. John Jothi 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

# **M.Phil ., Botany**

**THIAGARAJAR COLLEGE, MADURAI – 9.**  
**(Re-Accredited with ‘A’ Grade by NAAC)**  
**DEPARTMENT OF BOTANY**  
**(For those who join in 2017 and after))**

**MASTER OF PHILOSOPHY IN BOTANY**

**Course scheme and scheme of valuation**

**I semester**

| <b>Course</b> | <b>Code</b> | <b>Subject/Paper</b>                           | <b>Cont Hrs/w</b> | <b>Total Hrs</b> | <b>Max Mark CA</b> | <b>Max Mark SE</b> | <b>Total</b> |
|---------------|-------------|--|-------------------|------------------|--------------------|--------------------|--------------|
| Core 1        | 1 MB1       | Research Methodology                           | 6                 | 90               | 100                | 100                | 200          |
| Core 2        | 1MB2        | Frontiers in Conservation Biology              | 6                 | 90               | 100                | 100                | 200          |
| Core 3        | 1MB3        | Biomolecules and Signal Transduction in Plants | 6                 | 90               | 100                | 100                | 200          |

**II semester**

| <b>Course</b> | <b>Code</b> | <b>Subject/Paper</b> | <b>Cont Hrs/w</b> | <b>Total Hrs</b> | <b>Max Mark CA</b> | <b>Max Mark SE</b> | <b>Total</b> |
|---------------|-------------|----------------------|-------------------|------------------|--------------------|--------------------|--------------|
| Core 4        | MBD         | Dissertation*        |                   |                  |                    | 100                | 100          |
|               | VV          | 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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|   |                  |            |       |
|---|------------------|------------|-------|
| Course  | : M.Phil. Botany | Int. Marks | : 100 |
| Class   | : M.Phil         | Ext. Marks | : 100 |
| Semester  | : I              | Max. Marks | : 200 |
| Sub. Code                                       | : 1MB1           | Hours/Week | : 6   |
| Title of the Paper: <b>Research Methodology</b> |                  |            |       |

**Course Outcomes:**

On successful completion of the course the students will be able to

- undertake research through peer guidance
- apply Biotechniques in the classical and advanced research fields of Plant Biology
- apply the statistical concepts to solve the research methodology
- prepare scientific reports, dissertation, oral and poster presentation
- have awareness on plagiarism and get to know for the self-preparation

**Unit 1:** Microscopy: Structure, working principle and applications of Fluorescence microscope, Transmission electron microscope (TEM) and Scanning Electron microscope (SEM). Preparation of materials for SEM and TEM. Spectroscopy: Structure, working principle and applications of FTIR and NMR Spectrophotometer, Mass Spectroscopy-MALDI-TOF.

**Unit 2:** Chromatography: Principles and applications of chromatography HPLC and Gas chromatography. 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 good design – Important concepts relating to research design – Observation and Facts, Laws and Theories, Prediction and explanation, Induction, Deduction, Development of Models. Developing a research plan - Exploration, Description, Diagnosis and Experimentation

**Unit 4:** Statistical methods: principles of Experimental designs – Randomized and non-randomized block designs – ANOVA: One way and two way methods – Students ‘t’, LSD and chi-square tests Simple and linear regression- and correlation- Principle statistical method and interpretation Theoretical Distribution – Normal, Binomial and Poisson; Computation for Statistics: MS Excel and SPSS-PC

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

## **References:**

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

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|  |                  |            |       |
|--|------------------|------------|-------|
| Course   | : M.Phil. Botany | Int. Marks | : 100 |
| Class  | : M.Phil         | Ext. Marks | : 100 |
| Semester   | : I              | Max. Marks | : 200 |
| Sub. Code  | : 1MB2           | Hours/Week | : 6   |
| Title of the Paper: <b>Frontiers in Conservation Biology</b> |                  |            |       |

### **Course Outcomes**

On successful completion of the course the students will be able to

- define various aspects of biodiversity.
- explain significance of biodiversity and its conservation

**Unit 1:** Biodiversity- introduction- current state of biological diversity-Global patterns of species 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 indices: Dominance and evenness. Diversity crises in the geological past.

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

**Unit 3:** The effect of global climatic change on natural communities- IUCN categories of extinction- red data book – causes for species extinction – impact of exotic species on native species – GMOs and biosafety – Intellectual property rights- GATT,WTO, farmers and breeders rights- Biodiversity act 2002.

**Unit 4:** Remote sensing : Introduction-Analysis techniques-Digital image processing-Role of remote sensing in biodiversity management-GIS and biodiversity, landscape elements, Oceans colour and fishery, water security. Environment assessment and monitoring.

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

### **References:**

1. Stiling, P. 2002. Ecology – Theory and applications. Prentice-Hall of India Pvt. Ltd., New Delhi.
2. Gurevitch, J., Scheiner S.M and Fox G.A. 2002. The Ecology of Plants. Sinauer Associates Inc Publishers, Massachusetts.
3. Cunningham, W.P. and Cunningham, M.A. 2002. Principals of environmental science. Tata McGraw-Hill Publishing Company Ltd., New Delhi.
4. Agarwal, K.C. 2000 Biodiversity. Agrobios (India). Jodhpur.



5. Odum, E.P. 1971 Fundamentals of Ecology. W.B. Saunders Company, London.
6. Colinvaux, P.1986. Ecology John Wiley and sons, Singapore.
7. Krishnamoorthy, K.V. 2004 An advanced Text Book of Biodiversity. Oxford & IBH Publishing Co, Pvt. Ltd., New Delhi.
8. Meffe, G.K. and Carrol, R.C. 1994. Principles of Conservation of Biology, Sinauer Associates, Inc., Publishers, Saund

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|  |                  |            |       |
|--|------------------|------------|-------|
| Course   | : M.Phil. Botany | Int. Marks | : 100 |
| Class  | : M.Phil         | Ext. Marks | : 100 |
| Semester   | : I              | Max. Marks | : 200 |
| Sub. Code  | : 1MB3           | Hours/Week | : 6   |
| Title of the Paper: Biomolecules and signal transduction in Plants |                  |            |       |

**Course Outcomes:**

On successful completion of the course the students will be able to

- understand the structure and functions of biomolecules
- acquire knowledge about bioactive molecules
- study the principles and mechanisms involved in cell signaling and cell communication
- obtain the information about signal transduction in Plants

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

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

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

**References:**

1. Watson, J.D., Hopkins, N.H., Roberts, J.W., Steitz, J.A. and Weiner, A.M. 1987. Molecular Biology of the Gene, 4<sup>th</sup> Edition, Benjamin/ Cummings Publishing Company, California.
2. Kendrick, R.E. and Kronenberg, G.H.M.1994. Photomorphogenesis in plants, 2<sup>nd</sup> Edition, Kluwar Academic Publishers, Dordrecht.
3. Taiz, L. and Zeiger, E. 2002. Plant Physiology. The Benjamin and Cummings Publishers, California.
4. Mc.Donald, M.S. 2003. Photobiology of Higher Plants, John Wiley & Sons, Inc., West Sussex.
5. Roy, S.C.and Kalyan Kumar De. 2005. Cell Biology, 2<sup>nd</sup> Edition, New Central Book Agency (P) Ltd, Kolkata.
6. Desikar, R.N. 2005. Cell and Development Biotechnology, Dominant Publishers and Distributors, New Delhi.
7. 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.
8. Bradshaw, R.A. and Dennis, E.A. 2008. Handbook of Cell Signaling Three-Volume Set (e book). [http://ebookey.org/Handbook-of-Cell-Signaling-Three-Volume-Set\\_175281.html](http://ebookey.org/Handbook-of-Cell-Signaling-Three-Volume-Set_175281.html)
9. Baluka, F. and Vivanco, J. 2012. Signaling and Communication in Plants (e book). <http://freshbookers.com/ebook/9783642230462/ISBN>

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Course : M.Phil, Botany  
Semester. : II Sem  
Sub. Code : MBD & VV

Int. Marks : 100  
Ext. Marks : 100  
Max. Marks : 200

Title of the Paper: **Project**

# **B.Sc., Biotechnology**

**THIAGARAJAR COLLEGE, MADURAI – 9.****(Re-Accredited with ‘A’ Grade by NAAC)****DEPARTMENT OF BOTANY****(For those who join in 2017 and after))****BACHELOR OF BIOTECHNOLOGY****Semester –I**

| Course               | Code no  | Subject                     | Hrs/Week | credits | Total Hrs | Max Mark CA | Max Mark SE | Total |
|----------------------|----------|-----------------------------|----------|---------|-----------|-------------|-------------|-------|
| Part I               | P111     | Tamil                       | 6        | 3       | 90        | 25          | 75          | 100   |
| Part II              | P211     | English                     | 6        | 3       | 90        | 25          | 75          | 100   |
| Core I               | SMB11    | General Microbiology        | 6        | 6       | 90        | 25          | 75          | 100   |
| Core Lab 1           | SMBL11   | General Microbiology lab 1  | 4        | 2       | 60        | 40          | 60          | 100   |
| Generic Elective1    | SEGMB11  | Analytical Biochemistry     | 4        | 4       | 60        | 25          | 75          | 100   |
| Generic Elective lab | SEGMBL11 | Analytical Biochemistry Lab | 2        | -       | 30        |             |             |       |
| AECC1                | ES       | EVS                         | 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                | P121     | Tamil                                      | 6        | 3       | 90        | 25          | 75          | 100   |
| Part II               | P221     | English                                    | 6        | 3       | 90        | 25          | 75          | 100   |
| Core 2                | SMB21    | Cell Biology                               | 6        | 6       | 90        | 25          | 75          | 100   |
| Core Lab 2            | SMBL21   | Cell Biology Practical                     | 2        | 2       | 30        | 40          | 60          | 100   |
| Generic Elective 2    | SEGMB21  | Biomolecules                               | 4        | 4       | 60        | 25          | 75          | 100   |
| Generic Elective lab2 | SEGMBL21 | Analytical Biochemistry & Biomolecules lab | 2        | -       | 30        | 40          | 60          | 100   |
| AECC2                 | SBTAEC21 | 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                 | P131     | Tamil  | 6        | 3       | 90        | 25          | 75          | 100   |
| Part 2                 | P231     | English  | 6        | 3       | 90        | 25          | 75          | 100   |
| Core 3                 | SMB31    | Molecular Biology  | 4        | 4       | 45        | 25          | 75          | 100   |
| Core 4                 | SMB32    | Basics of Computers and Bioinformatics                               | 4        | 4       | 60        | 25          | 75          | 100   |
| Core lab3              | SMBL31   | Molecular biology & Basics of Computers and Bioinformatics Practical | 2        | 1       | 60        | 40          | 60          | 100   |
| Generic Elective 3     | SEGMB31  | Genetics & Biostatistics   | 4        | 4       | 60        | 40          | 60          | 100   |
| Generic Elective lab 3 | SEGMBL41 | Genetics & Biostatistics lab   | 2        |         | 30        | -           | -           | -     |
| NME1                   | SMBNME3  | 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               | P141      | Tamil   | 6        | 3       | 90        | 25          | 75          | 100   |
| Part 2               | P241      | English   | 6        | 3       | 90        | 25          | 75          | 100   |
| Core 5               | SMB41     | Immunology  | 4        | 4       | 45        | 25          | 75          | 100   |
| Core6                | SMB42     | Clinical Laboratory Technology  | 4        | 4       | 45        | 25          | 75          | 100   |
| Core lab 4           | SMBL41    | Immunology & Clinical laboratory technology   | 2        | 1       | 60        | 40          | 60          | 100   |
| Generic Elective 4   | SEGMB41   | Physiology  | 4        | 4       | 60        | 25          | 75          | 100   |
| G. Elective Lab3 & 4 | SEGMBL41  | Genetics & Biostatistics & Physiology lab   | 2        | 2       | 40        | 40          | 60          | 100   |
| SEC                  | SMBSE C41 | SEC(A) Mushroom Technology<br>SEC(B) Organic farming<br>SEC(C) & Plant Tissue Culture | 2        | 2       | 30        | 15          | 35          | 50    |
| Total                |           |   | 30       | 23      |           |             |             | 750   |

**Semester-V**

| Course | Code No | Subject | Hrs/ | Credit | Total | Max | Max | Total |
|--------|---------|---------|------|--------|-------|-----|-----|-------|
|--------|---------|---------|------|--------|-------|-----|-----|-------|

|            |          |  | Week | s  | Hrs | marks<br>CA | marks<br>SE |     |
|------------|----------|--|------|----|-----|-------------|-------------|-----|
| Core 7     | SMB51    | Genetic Engineering  | 5    | 5  | 60  | 25          | 75          | 100 |
| Core 8     | SMB52    | Industrial Biotechnology   | 4    | 4  | 60  | 25          | 75          | 100 |
| Core 9     | SMB53    | Marine Biotechnology   | 4    | 4  | 45  | 25          | 75          | 100 |
| Core lab 5 | SMBL51   | Genetic Engineering lab  | 3    | 2  | 60  | 40          | 60          | 100 |
| Core lab 6 | SMBL52   | Industrial Biotechnology lab   | 4    | 2  | 60  | 40          | 60          | 100 |
| Core lab 7 | SMBL53   | Marine Biotechnology lab   | 2    | 1  | 30  | 40          | 60          | 100 |
| M Elective | SEMMB51  | SEMB51 (A) Applied Microbiology<br>SEMB51 (B) Metabolic path ways<br>SEMB51 (C)infectious diseases | 4    | 5  | 75  | 25          | 75          | 100 |
| NME        | SMBNME51 | Vocational Biotechnology   | 2    | 2  | 30  | 15          | 35          | 50  |
| VE         | 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<br>CA | Max SE<br>marks | Total |
|--------------|----------|--|----------|---------|-----------|-----------------|-----------------|-------|
| Core10       | SMB61    | Plant Biotechnology  | 5        | 5       | 75        | 25              | 75              | 100   |
| Core11       | SMB62    | Animal Biotechnology   | 5        | 5       | 60        | 25              | 75              | 100   |
| Core12       | SMB63    | Environmental Biotechnology  | 4        | 4       | 60        | 25              | 75              | 100   |
| Core lab 8   | SMBL61   | Plant Biotechnology Practical  | 3        | 2       | 45        | 40              | 60              | 100   |
| Core lab 9   | SMBL62   | Animal Biotechnology   | 3        | 2       | 45        | 40              | 60              | 100   |
| Core lab 10  | SMBL63   | Environmental Biotechnology lab  | 4        | 2       | 60        | 40              | 60              | 100   |
| M Elective 2 | SEMMB61  | SEMB61(D) Genomics<br>SEMB61(E) Food Biotechnology<br>SEMB61(F) Biosafety&IPR<br>SEMB61(G) Biodiversity & conservation | 4        | 5       | 60        | 25              | 75              | 100   |
| SEC          | SMBSEC61 | SBE2(D)Herbal medicine<br>SBE2(E) Health & Hygiene<br>SBE2(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.           | 27      |
| Total    | 180 hrs           | 139     |

## 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                 |
|          | <b>Total</b>          | <b>139 Credits</b>             |

**THIAGARAJAR COLLEGE, MADURAI – 9.**

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|                     |                                      |            |       |
|---------------------|--------------------------------------|------------|-------|
| Course              | : B.Sc. Biotechnology                | Int. Marks | : 25  |
| Class               | : I Year                             | Ext. Marks | : 75  |
| Semester            | : I                                  | Max. Marks | : 100 |
| Sub. Code           | : SMB11                              | Hours/Week | : 6   |
| Title of the Paper: | <b>GENERAL MICROBIOLOGY (Core 1)</b> | Credits    | : 6   |

**Course outcomes:**

On the successful completion of the course, students will be able to

1. Acquire an exposure to the classification of microorganisms, diversity of microbial structure and their role.
2. Appreciate the importance of microbes.

**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 McGraw 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, Missouri.

**Course designer****1. S.Yogachitra**

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|                     |   |            |      |
|---------------------|---|------------|------|
| Course              | : B.Sc. Biotechnology (SF)                  | Int. Marks | : 40 |
| Class               | : I Year                                    | Ext. Marks | : 60 |
| Semester            | : I   | Max. Marks | :    |
| 100                 |   |            |      |
| Sub. Code           | : SMBL11                                    | Hours/Week | : 4  |
| Title of the Paper: | <b>General Microbiology Lab (Core Lab1)</b> | Credits    | : 2  |

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.
9. Growth curve.
10. Carbohydrate fermentation
11. IMVIC test
12. Starch hydrolysis
13. Catalase activity
14. Oxidase activity
15. Cellulose hydrolysis.

**THIAGARAJAR COLLEGE, MADURAI – 9.**  
**(Re-Accredited with ‘A’ Grade by NAAC)**  
**DEPARTMENT OF BOTANY**  
**(For those who join in 2017 and after))**

|                    |  |            |       |
|--------------------|--|------------|-------|
| Course             | : B.Sc. Biotechnology                                  | Int. Marks | : 25  |
| Class              | : I Year   | Ext. Marks | : 75  |
| Semester           | : I  | Max. Marks | : 100 |
| Sub. Code          | : SEGMB11  | Hours/Week | : 4   |
| Title of the Paper | : <b>Analytical Biochemistry</b> ( Generic Elective 1) | Credits    | : 4   |

**Course outcomes:**

On the successful completion of the course, students will be able to

- Understand the principles and working mechanisms of most common laboratory instruments.

**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 and quantification of DNA, RNA and Protein – principle – method. Purification of DNA, RNA and Protein – principle – method.

Electrophoresis: Principles–Types: Paper electrophoresis, Agarose Gel Electrophoresis (AGE) Polyacrylamide gel electrophoresis (PAGE) and Capillary electrophoresis (CE). Applications of electrophoresis.

**Text Books:**

1. Plummer, D. 1988. An introduction to Practical Biochemistry, Tata McGraw – Hill Publishing Company Ltd., New Delhi.
2. Rodney Boyer, 2000. Modern Experimental Biochemistry, 3rd Edition. Published by Addison Wesley Longman. Singapore.
3. Palanivelu, P. 2004. Laboratory Manual for analytical biochemistry and separation techniques, School of Biotechnology, Madurai Kamaraj university, Madurai.

**Reference Books:**

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

**THIAGARAJAR COLLEGE, MADURAI – 9.**  
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|                     |  |            |     |
|---------------------|--|------------|-----|
| Course              | : B.Sc. Biotechnology                                | Int. Marks | :   |
| Class               | : I Year   | Ext. Marks | :   |
| Semester            | : I  | Max. Marks | :   |
| Sub. Code           | : SEGMBL11   | Hours/Week | : 2 |
| Title of the Paper: | <b>Analytical Biochemistry</b> ( Generic Elective 1) | Credits    | : - |

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

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|                    |                               |            |       |
|--------------------|-------------------------------|------------|-------|
| Course             | : B.Sc. Biotechnology         | Int. Marks | : 25  |
| Class              | : I Year                      | Ext. Marks | : 75  |
| Semester           | : II                          | Max. Marks | : 100 |
| Sub. Code          | : SMB21                       | Hours/Week | : 6   |
| Title of the Paper | : <b>Cell Biology (Core2)</b> | Credits    | : 6   |

**Course outcomes:**

On the successful completion of the course, students will be able to

- Understand the basic structure and function of a cell. To make the students aware of the cellular organization and cell cycle.

**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, synaptonemes, 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.

**Text books:**

- 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

**THIAGARAJAR COLLEGE, MADURAI – 9.**  
**(Re-Accredited with ‘A’ Grade by NAAC)**  
**DEPARTMENT OF BOTANY**  
**(For those who join in 2017 and after))**

|                     |                                     |            |      |
|---------------------|-------------------------------------|------------|------|
| Course              | : B.Sc. Biotechnology               | Int. Marks | : 40 |
| Class               | : I Year                            | Ext. Marks | : 60 |
| Semester            | : II                                | Max. Marks | :    |
| 100                 |                                     |            |      |
| Sub. Code           | : SMBL21                            | Hours/Week | : 2  |
| Title of the Paper: | <b>Cell Biology Lab</b> (Core Lab2) | Credits    | : 2  |

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.

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|  |                       |            |      |
|--|-----------------------|------------|------|
| Course   | : B.Sc. Biotechnology | Int. Marks | : 25 |
| Class  | : I Year              | Ext. Marks | : 75 |
| Semester   | : II                  | Max. Marks | :    |
| 100  |                       |            |      |
| Sub. Code  | : SEGMB21             | Hours/Week | : 4  |
| Title of the Paper: <b>Biomolecules (Generic Elective 2/ Allied)</b> |                       | Credits    |      |
| : 4  |                       |            |      |

**Course Outcomes:**

On the successful completion of the course, students will be able to

- Analyze the molecular architecture of biomolecules.
- Learn the various concepts involved in the mechanism of enzyme action.

**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 quaternary structure

**Unit: III**

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

**Unit: IV**

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

**THIAGARAJAR COLLEGE, MADURAI – 9.**  
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**DEPARTMENT OF BOTANY**  
**(For those who join in 2017 and after))**

|                     |  |            |      |
|---------------------|--|------------|------|
| Course              | : B.Sc. Biotechnology(SF)                                    | Int. Marks | : 40 |
| Class               | : I Year   | Ext. Marks | : 60 |
| Semester            | : II   | Max. Marks | :    |
| 100                 |  |            |      |
| Sub. Code           | : SEGMBL21   | Hours/Week | : 2  |
| Title of the Paper: | <b>Biomolecules lab (Generic Elective lab 2/ Allied lab)</b> | Credit     | : 2  |
|                     | +Analytical Biochemistry                                     |            |      |

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

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|                     |                                |            |      |
|---------------------|--------------------------------|------------|------|
| Course              | : B.Sc. Biotechnology          | Int. Marks | : 15 |
| Class               | : I                            | Ext. Marks | : 35 |
| Semester            | : II                           | Max. Marks | : 50 |
| Sub.Code            | : SBTAEC21                     | Hours/Week | : 2  |
| Title of the Paper: | <b>Personality Development</b> | Credits    | : 2  |

**Course Outcomes**

On the successful completion of the course, students will be able to

- understand the cause of a problem and way to solve it
- be acquainted with different and difficult situations

**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.

**Text books**

1. N.Chockan 2011 Learn to understand others, Prodigy books, Chennai
2. Machakkalai, R and L. Saraswathi 2005. Personality development a need. Mangai Publishers, Madurai

**Reference books**

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

Course designer  
Dr.Jegathesan

**THIAGARAJAR COLLEGE, MADURAI – 9.**  
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**DEPARTMENT OF BOTANY**  
**(w.e.f. 2017 Batch onwards)**

|                     |                                   |            |      |
|---------------------|-----------------------------------|------------|------|
| Course              | : B.Sc. Biotechnology             | Int. Marks | : 25 |
| Class               | : II Year                         | Ext. Marks | : 75 |
| Semester            | : III                             | Max. Marks | :    |
|                     | 100                               |            |      |
| Sub. Code           | : SMB31                           | Hours/Week | : 4  |
| Title of the Paper: | <b>Molecular Biology</b> (Core 3) | Credits    | : 4  |

**Course Outcomes:**

On the successful completion of the course, students will be able to

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

**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, 2<sup>nd</sup> edition. Narosa Publishing House, New Delhi.
- Turner, P. C. 2001. Plant Molecular Biology, 2<sup>nd</sup> edition. Bios scientific publishers, Oxford

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

**Reference Books:**

- James Watson, D. 2004. Molecular Biology of Gene, 5<sup>th</sup> edition. Pearson education publication, Singapore.
- Benjamin Lewin. 2008. Gene IX. Oxford university press, Oxford



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|                     |   |            |      |
|---------------------|---|------------|------|
| Course              | : B.Sc. Biotechnology                               | Int. Marks | : 25 |
| Class               | : II Year   | Ext. Marks | : 75 |
| Semester            | : III   | Max. Marks | :    |
| 100                 |   |            |      |
| Sub. Code           | : SMB32   | Hours/Week | : 4  |
| Title of the Paper: | <b>Basics of Computer and Bioinformatics(Core4)</b> | Credits    | : 4  |

**Course Outcomes:**

On the successful completion of the course, students will be able to

- Have the basic knowledge on the role of computer in biological research.
- Students will acquire the basic information on computing, internet and literature Search.
- To have training in biological databases and types of data analysis

**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, EMBL, Swissprot.

**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

**THIAGARAJAR COLLEGE, MADURAI – 9.**  
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|   |                           |            |      |
|---|---------------------------|------------|------|
| Course  | : B.Sc. Biotechnology(SF) | Int. Marks | : 40 |
| Class   | : II Year                 | Ext. Marks | : 60 |
| Semester  | : III                     | Max. Marks | :    |
|   | 100                       |            |      |
| Sub. Code   | : SMBL31                  | Hours/Week | : 2  |
| Title of the Paper: <b>Molecular Biology, Basics of Computers and Bioinformatics lab (Core Lab 3)</b> |                           |            |      |
| Credits   | : 1                       |            |      |

**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
11. Gradient plate technique

**Basics of Computers 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-number 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 numbering.
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.

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|  |                       |            |      |
|--|-----------------------|------------|------|
| Course   | : B.Sc. Biotechnology | Int. Marks | : 25 |
| Class  | : II Year             | Ext. Marks | : 75 |
| Semester   | : 3                   | Max. Marks | :    |
| 100  |                       |            |      |
| Sub. Code  | : SEGMB31             | Hours/Week | : 4  |
| Title of the Paper: <b>Genetics and Biostatistics (Generic Elective 3 /Allied)</b> |                       | Credits    | : 4  |

**Course Outcomes:**

On the successful completion of the course, students will be able to

- Apply the various concepts involved in Genetics.
- Learn the various statistical principles and methods in biology.

**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 *Paramecium*, 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, 9<sup>th</sup> edition. S. Chand & Sons Publishers, New Delhi.

**Reference Books:**

- Strickberger, M.W., 2008. Genetics, 3<sup>rd</sup> Ed., MacMillan Publishing, New York.
- Gardner, E.J. and J. Michael Simmons. 2006. Principle of genetics 8<sup>th</sup> edition, John Wiley & Sons, New York.

**Course designer**

1. S.Yogachitra

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|                     |   |            |      |
|---------------------|---|------------|------|
| Course              | : B.Sc. Biotechnology   | Int. Marks | : 40 |
| Class               | : II Year   | Ext. Marks | : 60 |
| Semester            | : 3   | Max. Marks | :    |
|                     | 100   |            |      |
| Sub. Code           | : SEGMBL41  | Hours/Week | : 2  |
| Title of the Paper: | <b>Genetics and Biostatistics (Generic Elective lab 3/Allied)</b> | Credits    |      |
|                     | : -   |            |      |

**To work out**

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

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|                     |                                   |            |      |
|---------------------|-----------------------------------|------------|------|
| Course              | : B.Sc. Biotechnology             | Int. Marks | : 15 |
| Class               | : II Year                         | Ext. Marks | : 35 |
| Semester            | : 3                               | Max. Marks | : 50 |
| Sub. Code           | : SMBNME31                        | Hours/Week | : 2  |
| Title of the Paper: | <b>Food Processing Technology</b> | Credits    | : 2  |

**Course Outcomes:**

On the successful completion of the course, students will be able to

- Acquire basic knowledge & develop suitable skills involved in microbial protein production.
- Trained in food processing technology.
- Learn to occupy oneself during leisure time.

**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, 3<sup>rd</sup> 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, 2<sup>nd</sup> 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**

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**DEPARTMENT OF BOTANY**  
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|   |                       |            |      |
|---|-----------------------|------------|------|
| Course                                  | : B.Sc. Biotechnology | Int. Marks | : 25 |
| Class                                   | : II Year             | Ext. Marks | : 75 |
| Semester                                | : 4                   | Max. Marks | :    |
| 100                                     |                       |            |      |
| Sub. Code                               | : SMB41               | Hours/Week | : 4  |
| Title of the Paper: Immunology (Core 5) |                       | Credits    | : 4  |

**Course Outcomes:**

On the successful completion of the course, students will be able to

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

**Unit: I**

Elements of immunology – Primary and secondary lymphoid organs, Thymus, Bone marrow, Bursa of Fabricus, lymph node and spleen. Cells of the lymphoreticular 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, 2<sup>nd</sup> 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, 4<sup>th</sup> edition. W.B.Saunders Company, Philadelphia



**Reference Books:**

- Abbas, A.K. 2004. Basic immunology 2<sup>nd</sup> edition. Saunders- Elsevier, Philadelphia.
- Kubey, 1997. Immunology 3<sup>rd</sup> edition. Freeman Publishers , New York.
- Klaus. D. Elgert. 2009. Immunology: Understanding the immune system. Wiley – Blackwell inc.
- Peter J. Delves, Seamus J. Martin, Dennis R. Burton, Ivan M. Roitt , 2016, Roitt's Essential Immunology .Wiley – Blackwell inc.

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|   |                       |            |      |
|---|-----------------------|------------|------|
| Course  | : B.Sc. Biotechnology | Int. Marks | : 40 |
| Class   | : II Year             | Ext. Marks | : 60 |
| Semester  | : 4                   | Max. Marks | :    |
|   | 100                   |            |      |
| Sub. Code   | : SMBL41              | Hours/Week | : 2  |
| Title of the Paper: <b>Immunology and Clinical Laboratory Technology Lab (Core Lab 4)</b> |                       |            |      |
|   | Credits               | :          | 1    |

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

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|                     |  |            |      |
|---------------------|--|------------|------|
| Course              | : B.Sc. Biotechnology                                      | Int. Marks | : 40 |
| Class               | : II Year  | Ext. Marks | : 60 |
| Semester            | : 4  | Max. Marks | :    |
| 100                 |  |            |      |
| Sub. Code           | : SMBL41   | Hours/Week | : 2  |
| Title of the Paper: | <b>Immunology &amp; Clinical Laboratory Technology Lab</b> | Credits    | : 1  |

1. Blood glucose(Fasting and Post Prandial)
2. WIDAL test
3. Measurement of Bleeding time and Clotting time
4. Culture analysis of Urine and blood
5. Physical and microscopic examination of urine
6. Erythrocyte Sedimentation Rate(ESR)
7. Urine Pregnancy test
8. VDRL
9. Estimation of cholesterol

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|                     |  |            |      |
|---------------------|--|------------|------|
| Course              | : B.Sc. Biotechnology                          | Int. Marks | : 25 |
| Class               | : II Year                                      | Ext. Marks | : 75 |
| Semester            | : 4  | Max. Marks | :    |
| 100                 |  |            |      |
| Sub. Code           | : SMB42  | Hours/Week | : 3  |
| Title of the Paper: | <b>Clinical Laboratory Technology (Core 6)</b> | Credits    | : 4  |

**Course Outcomes:**

On the successful completion of the course, students will be able to

- Study different parameters involved in normal health.
- Learn the different methods of analyzing body fluids.

**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 – 2<sup>nd</sup> ed. – Hill Publishing Ltd., New Delhi.
- Connie R. Mahon. Diane G. Tice. 2006. Clinical Laboratory Immunology. 8<sup>th</sup> edition. Pearson Prentice Hall. 325 pp.

**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.

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|                     |  |            |      |
|---------------------|--|------------|------|
| Course              | : B.Sc. Biotechnology                  | Int. Marks | : 25 |
| Class               | : II Year                              | Ext. Marks | : 75 |
| Semester            | : IV                                   | Max. Marks | :    |
| 100                 |  |            |      |
| Sub. Code           | : SEGMB41                              | Hours/Week | : 4  |
| Title of the Paper: | <b>Physiology (Generic Elective 4)</b> | Credits    | : 4  |

**Course Outcomes:**

On the successful completion of the course, students will be able to

- Have the basic knowledge on different physiological and biochemical mechanisms in plants and animals and their adaptations.

**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<sup>+</sup> 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: C<sub>3</sub>, C<sub>4</sub> 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**

- Bijlani, R.L. 2001. Fundamentals of Physiology. I edn. JayPee brothers, New Delhi
- Subrahmanyam, S., Madhavankutty, K. and Singh, H.D. 1996 (Eds). Text Book of Human Physiology. S. Chand & Company Ltd. New Delhi.

### **References**

- Clancy, J. and Mc Vicar, A.J. 1995. Physiology and anatomy. Edward Arnold, London.
- 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
- Joshi, A.S. 1998. Human Physiology. VI Edn., The Benjamin/Cummings Publishing Company, Californi

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|---------------------|---|------------|------|
| Course              | : B.Sc. Biotechnology                                 | Int. Marks | : 40 |
| Class               | : II Year   | Ext. Marks | : 60 |
| Semester            | : 4   | Max. Marks | :    |
| 100                 |   |            |      |
| Sub. Code           | : SEGMBL41  | Hours/Week | : 2  |
| Title of the Paper: | <b>Physiology Lab+ Genetics and Biostatistics lab</b> | Credits    | :1   |
|                     | (Generic elective lab4)                               |            |      |

**Physiology**

1. Estimation of blood sugar
2. Demonstration 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 Glucose
8. Estimation of Blood Urea
9. Determination of blood pressure using Sphygmomanometer
10. Qualitative analysis of urine for albumin, sugar, ketone bodies and bile salts
11. Qualitative analysis excretory products –Ammonia, urea, uric acid
12. Determination of sperm count and its motility



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|                     |                            |            |      |
|---------------------|----------------------------|------------|------|
| Course              | : B.Sc. Biotechnology      | Int. Marks | : 15 |
| Class               | : II Year                  | Ext. Marks | : 35 |
| Semester            | : IV                       | Max. Marks | : 50 |
| Sub. Code           | : SMBSEC41                 | Hours/Week | : 2  |
| Title of the Paper: | <b>Mushroom Technology</b> | Credits    | : 2  |

**Course Outcome:**

On the successful completion of the course, students will be able to

- Acquire basic knowledge and develop suitable skills involved in mushroom cultivation.
- Learn to occupy oneself during leisure time.

**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 don’t’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. 3<sup>rd</sup> edition. Oxford & IBH Co Ltd, New Delhi.
- Kapoor, J.N.2014. Mushroom cultivation ICAR. New Delhi.
- Banwari George, J. 1998. Basic food microbiology, 2<sup>nd</sup> Edition. CBS publishers and distributors, New Delhi.

**Reference Books:**

- Aneja, K.R. 1996. Experiments in Microbiology, Plant pathology. 4<sup>th</sup> edition. Tissue culture and Mushroom cultivation. Wishwa Prakashan, (New Age International (p) Ltd), New Delhi

**Course designer**

1. S.Yogachitra

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|                     |                        |            |      |
|---------------------|------------------------|------------|------|
| Course              | : B.Sc. Biotechnology  | Int. Marks | : 15 |
| Class               | : II Year              | Ext. Marks | : 35 |
| Semester            | : IV                   | Max. Marks | : 50 |
| Sub. Code           | : SMBSEC41             | Hours/Week | : 2  |
| Title of the Paper: | <b>Organic Farming</b> | Credits    | : 2  |

**Course Outcome:**

On the successful completion of the course, students will be able to

- Acquire basic knowledge on organic farming and their role in the maintenance of soil fertility.
- Adequate information on the application and career options in the field of biofertilizers.

**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

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|                     |                             |            |      |
|---------------------|-----------------------------|------------|------|
| Course              | : B.Sc. Biotechnology       | Int. Marks | : 15 |
| Class               | : II Year                   | Ext. Marks | : 35 |
| Semester            | : IV                        | Max. Marks | : 50 |
| Sub. Code           | : SMBSEC41                  | Hours/Week | : 2  |
| Title of the Paper: | <b>Plant Tissue Culture</b> | Credits    | : 2  |

**Course Outcome:**

On the successful completion of the course, students will be able to

- Familiar with the basic principles and techniques in tissue culture
- Know about the various techniques employed in 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.

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|                     |                                     |            |       |
|---------------------|-------------------------------------|------------|-------|
| Course              | : B.Sc. Biotechnology               | Int. Marks | : 25  |
| Class               | : III Year                          | Ext. Marks | : 75  |
| Semester            | : V                                 | Max. Marks | : 100 |
| Sub. Code           | : SMB51                             | Hours/Week | : 5   |
| Title of the Paper: | <b>Genetic Engineering (Core 7)</b> | Credits    | : 5   |

**Course Outcome:**

On the successful completion of the course, students will be able to

- Learn the recent development in gene technology. To appreciate the advancement in genetic engineering.
- Acquire knowledge about the various methods of gene transfer and manipulation.

**Unit I**

Principles of genetic engineering , Restriction enzymes – nomenclature , classification , types. DNA modifying 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:  $\alpha$  -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, 5<sup>th</sup> 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, 7<sup>th</sup> 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, 11<sup>th</sup> edition. Genes IX, Oxford University Press, Oxford, U.K.
- Winnaker, E.L., 2003. From Genes to Clone: Introduction to Gene Technology, VCH publications, Weinbeim Fedrerel Republic German.

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|                     |  |            |       |
|---------------------|--|------------|-------|
| Course              | : B.Sc. Biotechnology                      | Int. Marks | : 40  |
| Class               | : III Year                                 | Ext. Marks | : 60  |
| Semester            | : V  | Max. Marks | : 100 |
| Sub. Code           | : SMBL 51                                  | Hours/Week | : 3   |
| Title of the Paper: | <b>Genetic Engineering Lab (Core Lab5)</b> | Credits    | : 2   |

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

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|---------------------|--|------------|-------|
| Course              | : B.Sc. Biotechnology                    | Int. Marks | : 25  |
| Class               | : III Year                               | Ext. Marks | : 75  |
| Semester            | : V                                      | Max. Marks | : 100 |
| Sub. Code           | : SMB52                                  | Hours/Week | : 4   |
| Title of the Paper: | <b>Industrial Biotechnology (Core 8)</b> | Credits    | : 4   |

**Course Outcome:**

On the successful completion of the course, students will be able to

- Understand the principles and strategies involved in using biological systems for technological applications.
- Develop an appreciation of the complex strategies involved in a biotechnological process.

**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  $\alpha$  – 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, 2<sup>nd</sup> edition. Industrial Microbiology. Macmillan India Ltd, Delhi.
- Crueger, W. and A. Crueger. 2002, 2<sup>nd</sup> 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 designer**

1. S.Yogachitra



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|                     |   |            |       |
|---------------------|---|------------|-------|
| Course              | : B.Sc. Biotechnology                           | Int. Marks | : 40  |
| Class               | : III Year                                      | Ext. Marks | : 60  |
| Semester            | : V   | Max. Marks | : 100 |
| Sub. Code           | : SML 52  | Hours/Week | : 4   |
| Title of the Paper: | <b>Industrial Biotechnology Lab(Core Lab 6)</b> | Credits    | : 2   |

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

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|                     |                                      |            |       |
|---------------------|--------------------------------------|------------|-------|
| Course              | : B.Sc. Biotechnology                | Int. Marks | : 25  |
| Class               | : III Year                           | Ext. Marks | : 75  |
| Semester            | : V                                  | Max. Marks | : 100 |
| Sub. Code           | : SMB53                              | Hours/Week | : 4   |
| Title of the Paper: | <b>Marine Biotechnology (Core 9)</b> | Credits    | : 4   |

**Course Outcome:**

On the successful completion of the course, students will be able to

- Understand the ecological importance of oceanic habitat.
- Appreciate and admire artistic beauty of marine seaweeds peculiar to themselves. To stimulate the curiosity of the students to unfold the Marine biotechnology in the wider biological sense.

**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. Nutraceuticals: Micro algal products –

Pigments, Anti-oxidant, Omega-3 Fatty acids and Immune system stimulant. Fodder: Seaweed meal for Pisciculture, 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. Today's & 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

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|                     |   |            |       |
|---------------------|---|------------|-------|
| Course              | : B.Sc. Biotechnology                       | Int. Marks | : 40  |
| Class               | : III Year                                  | Ext. Marks | : 60  |
| Semester            | : V   | Max. Marks | : 100 |
| Sub. Code           | : SMBL 53                                   | Hours/Week | : 2   |
| Title of the Paper: | <b>Marine Biotechnology Lab (Core Lab7)</b> | Credits    | : 1   |

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.

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|---------------------|--|------------|-------|
| Course              | : B.Sc. Biotechnology                          | Int. Marks | : 25  |
| Class               | : III Year                                     | Ext. Marks | : 75  |
| Semester            | : V  | Max. Marks | : 100 |
| Sub. Code           | : SEMMB51(A)                                   | Hours/Week | : 4   |
| Title of the Paper: | <b>Applied Microbiology (Major Elective 1)</b> | Credits    | : 5   |

**Course Outcome:**

On the successful completion of the course, students will be able to

- Gain an understanding of the role of microorganisms in food, agro and environmental microbiology.
- Understand the conceptual applications of microbes in various fields

**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 poisoning), 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, Mumbai
- 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

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|                     |  |            |       |
|---------------------|--|------------|-------|
| Course              | : B.Sc. Biotechnology                      | Int. Marks | : 25  |
| Class               | : III Year                                 | Ext. Marks | : 75  |
| Semester            | : V  | Max. Marks | : 100 |
| Sub. Code           | : SEMMB51(M)                               | Hours/Week | : 4   |
| Title of the Paper: | <b>Metabolic Pathways (Major Elective)</b> | Credits    | : 5   |

**Course Outcome:**

On the successful completion of the course, students will be able to

- Understand the types of metabolic pathways and the role of common intermediate compounds.
- Learn the biosynthesis and breakdown of biomolecules.

**Unit I**

Introduction –Types of metabolic pathways: Catabolic, anabolic, cyclic, anapluerotic, amphibolic Pathways, 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:  $\beta$  oxidation,  $\alpha$  oxidation.

**Unit IV**

Biosynthesis of Aminoacid (Overview) – Protein degradation, oxidative deamination – Urea cycle – transamination.

**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<sup>th</sup> 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<sup>th</sup> edition. W.H. Free Man & Company New York.
- Voet , D. and Voet, J.D. 1990, 4<sup>th</sup> edition. Biochemistry. John Wily & Sons, New York

**Course designer**

1. S.Siva Durga

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|                     |   |            |       |
|---------------------|---|------------|-------|
| Course              | : B.Sc. Biotechnology                       | Int. Marks | : 25  |
| Class               | : III Year                                  | Ext. Marks | : 75  |
| Semester            | : V   | Max. Marks | : 100 |
| Sub. Code           | : SEMMB51 (I)                               | Hours/Week | : 4   |
| Title of the Paper: | <b>Infectious Diseases(Major Elective )</b> | Credits    | : 5   |

**Course Outcome:**

On the successful completion of the course, students will be able to

- Create an awareness among the students about the human, animal and plant 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, Bhandi 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., New Delhi.
- 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. Engberg., B. I. Eisenstein and G. Medoff . 1999. Mechanisms of Microbial diseases, 3<sup>rd</sup> edition. Lippincott Williams and Wilkins. Philadelphia

**Course designer**

1. **S.Siva Durga**



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**DEPARTMENT OF BOTANY**

**(w.e.f. 2017 Batch onwards)**

|                     |                                 |            |      |
|---------------------|---------------------------------|------------|------|
| Course              | : B.Sc. Biotechnology           | Int. Marks | : 15 |
| Class               | : III Year                      | Ext. Marks | : 35 |
| Semester            | : V                             | Max. Marks | : 50 |
| Sub. Code           | : SMBNME51                      | Hours/Week | : 2  |
| Title of the Paper: | <b>Vocational Biotechnology</b> | Credits    | : 2  |

**Course Outcome:**

On the successful completion of the course, students will be able to

- Know about the organic farming and their role in the maintenance of soil fertility.
- Acquire basic knowledge and develop suitable skills involved in microbial protein production.
- Learn to occupy oneself during leisure time.

**Unit 1:**

Organic farming Technology : Composting methods – Indoor and Berkely method – Vermiculture. Vermicomposting – Vermiwash - Preparation of panchakavya and its applications. Advantages of Organic farming.

**Unit 2:**

Microbial protein production technology: cultivation methods for Algal-Spirulina , Fungal-yeast –importance of single cell proteins. 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:**

Siva durga

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|                     |                                    |            |       |
|---------------------|------------------------------------|------------|-------|
| Course              | : B.Sc. Biotechnology              | Int. Marks | : 25  |
| Class               | : III Year                         | Ext. Marks | : 75  |
| Semester            | : VI                               | Max. Marks | : 100 |
| Sub. Code           | : SMB61                            | Hours/Week | : 5   |
| Title of the Paper: | <b>Plant Biotechnology(Core10)</b> | Credits    | : 5   |

**Course Outcome:**

On the successful completion of the course, students will be able to

- Acquire knowledge on basic principles and techniques in plant tissue culture. Students will have the knowledge on safe handling and maintenance of transgenic plants and products.

**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.

**Text Books:**

- Old, R. W. and S. B. Primrose. 2000. Principles of gene manipulation. An introduction to genetic engineering, 5th edition. Blackwell Science Ltd., Oxford.
- Winnacker, E. N. 2003. From genes to clones. Panama publishing corporation Pvt., Ltd., New Delhi.
- Subha Rao, N. S. 2003. Soil Microbiology 4th edition. Oxford & IBH Publishing Co, Pvt Ltd, New Delhi.

- Philip and Gamborg. 2010. Plant Cell and Tissue Culture. Oxford & IBH Publishing Co, Pvt Ltd, New Delhi.

**Reference Books:**

- Chawla, H.S. 2004 Introduction to Plant Biotechnology, 2nd edition. Oxford publishing Co. Pvt Ltd, New Delhi.
- Bhojwani, Razdan and M. K. Razdan. 1994. Plant Tissue culture. Elsevier North Holland
- Slater. 2010. Plant Biotechnology. Oxford publishing Co. Pvt Ltd, New Delhi.

**Course designed by:**

Dr. K. Thangavel

**THIAGARAJAR COLLEGE, MADURAI – 9.**  
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|                     |  |            |       |
|---------------------|--|------------|-------|
| Course              | : B.Sc. Biotechnology                      | Int. Marks | : 40  |
| Class               | : III Year                                 | Ext. Marks | : 60  |
| Semester            | : VI                                       | Max. Marks | : 100 |
| Sub. Code           | : SML 61                                   | Hours/Week | : 3   |
| Title of the Paper: | <b>Plant Biotechnology Lab(Core Lab 8)</b> | Credits    | : 2   |

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 transplanting.
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.
11. Extraction of DNA from plant tissue.

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|---------------------|--------------------------------------|------------|-------|
| Course              | : B.Sc. Biotechnology                | Int. Marks | : 25  |
| Class               | : III Year                           | Ext. Marks | : 75  |
| Semester            | : VI                                 | Max. Marks | : 100 |
| Sub. Code           | : SMB62                              | Hours/Week | : 3   |
| Title of the Paper: | <b>Animal Biotechnology(Core 11)</b> | Credits    | : 2   |

**Course Outcome:**

On the successful completion of the course, students will be able to

- Understand the mammalian cell culture and transgenic animal technology
- Acquire knowledge on the production of biotechnological molecules and pre implanted genetic diagnosis in human beings.

**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 – 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 3<sup>rd</sup> edition. Agrobios, Jodhpur
- Prakash. M, and K. Arora. 1998. Cell & tissue culture 1<sup>st</sup> Edition, Anomol publication, New Delhi.

- Jogdand, S. N. 2001. Advances in Biotechnology 3<sup>rd</sup> edition. Himalaya Publishing House, Mumbai.

**Reference Books:**

- Glick, B. R. and J. J. Pasternak. 2010. Molecular biotechnology. Principles and application of Recombinant DNA;4<sup>th</sup> edition. ASM press Washington D.C

**Course designer**

1. S.Siva Durga

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|---------------------|---|------------|-------|
| Course              | : B.Sc. Biotechnology                       | Int. Marks | : 40  |
| Class               | : III Year                                  | Ext. Marks | : 60  |
| Semester            | : VI  | Max. Marks | : 100 |
| Sub. Code           | : SMBL 62                                   | Hours/Week | : 3   |
| Title of the Paper: | <b>Animal Biotechnology Lab (Core Lab9)</b> | Credits    | : 2   |

1. Blood grouping.
2. Haemagglutination – Immuno-electrophoresis
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)

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|---------------------|--|------------|-------|
| Course              | : B.Sc. Biotechnology                      | Int. Marks | : 25  |
| Class               | : III Year                                 | Ext. Marks | : 75  |
| Semester            | : VI                                       | Max. Marks | : 100 |
| Sub. Code           | : SMB63                                    | Hours/Week | : 4   |
| Title of the Paper: | <b>Environmental Biotechnology(Core12)</b> | Credits    | : 4   |

**Course Outcome:**

On the successful completion of the course, students will be able to

- Learn the principles and concepts of environmental biotechnology.
- Impart knowledge on waste disposal and bioleaching.
- Introduce the concept of bioremediation.

**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 dairy, 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, 4<sup>th</sup> edition. Soil microbiology. Raju Primplani Publishing Pvt. Ltd., New Delhi.
- Dash, M.C. 2011. Fundamentals of ecology, 2<sup>nd</sup> edition, Tata McGraw Hill Publishing company Ltd., New Delhi.
- Alexander Glazer, N. 2007, 2<sup>nd</sup> 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, 6<sup>th</sup> edition. Himalaya Publishing House, Mumbai.
- Markandy, D.K and N. Rajvaidys. 2004. Environmental Biotechnology. APH Publishing Corporation, New Delhi.

**Course designer**

1. S.Yogachitra

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|                     |  |            |       |
|---------------------|--|------------|-------|
| Course              | : B.Sc. Biotechnology                              | Int. Marks | : 40  |
| Class               | : III Year   | Ext. Marks | : 60  |
| Semester            | : VI   | Max. Marks | : 100 |
| Sub. Code           | : SMBL 63  | Hours/Week | : 4   |
| Title of the Paper: | <b>Environmental Biotechnology Lab(Core Lab10)</b> | Credits    | : 2   |

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

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|---------------------|------------------------------------|------------|-------|
| Course              | : B.Sc. Biotechnology              | Int. Marks | : 25  |
| Class               | : III Year                         | Ext. Marks | : 75  |
| Semester            | : VI                               | Max. Marks | : 100 |
| Sub. Code           | : SEMMB61(D)                       | Hours/Week | : 4   |
| Title of the Paper: | <b>Genomics (Major Elective 2)</b> | Credits    | : 5   |

**Course Outcome:**

On the successful completion of the course, students will be able to

- Have basic knowledge on Genomics. To study the tools for genome analysis.

**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, Wiley – 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 Frontiers 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

**THIAGARAJAR COLLEGE, MADURAI – 9.**  
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|                     |   |            |       |
|---------------------|---|------------|-------|
| Course              | : B.Sc. Biotechnology                       | Int. Marks | : 25  |
| Class               | : III Year                                  | Ext. Marks | : 75  |
| Semester            | : VI  | Max. Marks | : 100 |
| Sub. Code           | : SEMMB61(E)                                | Hours/Week | : 4   |
| Title of the Paper: | <b>Food Biotechnology(Major Elective 2)</b> | Credits    | : 5   |

**Course outcomes:**

On the successful completion of the course, students will be able to

- Learn pertinent facts concerning the role of microorganisms in food preservation, spoilage, and food poisoning.
- Learn the role and significance of various indicator and disease-producing microorganisms in food, water, and wastewater.
- Observe standard procedures to detect microorganisms in food , water, and wastewater.

**Unit I**

Introduction to food microbiology - Scope of food microbiology, food as a Substrate for microorganisms, microorganisms important in food industry. *Saccharomyces cerevisiae*, *Lactobacillus sp.*

**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

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|                     |  |            |       |
|---------------------|--|------------|-------|
| Course              | : B.Sc. Biotechnology  | Int. Marks | : 25  |
| Class               | : III Year   | Ext. Marks | : 75  |
| Semester            | : VI   | Max. Marks | : 100 |
| Sub. Code           | : SEMMB61(F)   | Hours/Week | : 4   |
| Title of the Paper: | <b>Biosafety And Intellectual Property Rights(Majorelective 2)</b> | Credits    |       |
|                     | : 5  |            |       |

**Course Outcome:**

On the successful completion of the course, students will be able to

- Acquire knowledge and to develop a sense of responsibility towards Biosafety.
- Understand and have a basic knowledge of Patenting
- Make them aware of the avenues for self-employment
- Develop skills in entrepreneurship among the students.

**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<sup>th</sup> edition. a Text book of Biotechnology .S. Chand & Co, New Delhi.
- Jogdand,. S. N 2001. Advances in Biotechnology 3<sup>rd</sup> edition; Himalaya Publishing House, Mumbai.
- Old, R. W. and S. B. Primrose. 1994. Principles of gene manipulation. An introduction to genetic engineering, 5<sup>th</sup> edition. Blackwell Science Ltd.,
- Patel, A.H. 2016, 2<sup>nd</sup> 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<sup>th</sup> edition. ASM press, Washington D.C.



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|                     |   |            |             |
|---------------------|---|------------|-------------|
| Course              | : B.Sc. Biotechnology                                   | Int. Marks | : 25        |
| Class               | : III Year  | Ext. Marks | : 75        |
| Semester            | : VI  | Max. Marks | : 100       |
| Sub. Code           | : SEMMB61(G)  | Hours/Week | : 4         |
| Title of the Paper: | <b>Biodiversity and Conservation (Major Elective 2)</b> |            | Credits : 5 |

**Course Outcome:**

On the successful completion of the course, students will be able to

- Acquire the knowledge on biodiversity and its level. To acquire the information regarding the strategies for the conservation of biodiversity.

**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. Kandyia, 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 Serdang, Selangor, Malaysia.
- Soule, M.E. (ed.) (1986). Conservation Biology. The Science of Scarcity and Diversity. Sinaur Associates, Inc., Sunderland, Massachusetts.

#### **Course designed by:**

1. Dr. K. Thangavel

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|                     |   |                 |
|---------------------|---|-----------------|
| Course              | : B.Sc. Biotechnology                             | Int. Marks: 15  |
| Class               | : III Year  | Ext. Marks : 35 |
| Semester            | : VI  | Max. Marks : 50 |
| Sub. Code           | : SMBSEC61(D)                                     | Hours/Week : 2  |
| Title of the Paper: | <b>Herbal Medicine (Skill Enhancement Course)</b> | Credits : 2     |

**Course Outcome:**

On the successful completion of the course, students will be able to

- Realize the significance of medicinal plants.
- Understand the medicinal importance of plants.

**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 pharmacognosy. 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. Yoga chitra
2. S. Siva Durga

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|---------------------|---|------------|------|
| Course              | : B.Sc. Biotechnology                               | Int. Marks | : 15 |
| Class               | : III Year  | Ext. Marks | : 35 |
| Semester            | : VI  | Max. Marks | : 50 |
| Sub. Code           | : SMBSEC61(E)                                       | Hours/Week | : 2  |
| Title of the Paper: | <b>Health and Hygiene(Skill Enhancement Course)</b> | Credits    | : 2  |

**Course Outcome:**

On the successful completion of the course, students will be able to

- Acquire knowledge on general health and nutrition.
- Follow hygienic practices

**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. Muruges, 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.

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|                     |                                       |            |      |
|---------------------|---------------------------------------|------------|------|
| Course              | : B.Sc. Biotechnology                 | Int. Marks | : 15 |
| Class               | : III Year                            | Ext. Marks | : 35 |
| Semester            | : VI                                  | Max. Marks | : 50 |
| Sub. Code           | : SMBSEC61(F)                         | Hours/Week | : 2  |
| Title of the Paper: | <b>Microscopy and Microtechniques</b> | Credits    | : 2  |
|                     | <b>(Skill Enhancement Course)</b>     |            |      |

**Course Outcome:**

On the successful completion of the course, students will be able to

- Understand the principle and mechanism involved in different microscopes.
- Learn the methods of preparing stains for microscopic study.

**Unit I**

Microscopy:simple and compound microscope, Light,Dark field,Phase contrast, Fluorescent, 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.Gurumani,N.2006.Research methodology for biologicalmsciences, MJ publishers, Chennai
- 2.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. ata MC Graw- Hill publishing company Ltd.New Delhi.