

THIAGARAJAR COLLEGE (AUTONOMOUS) MAUDURAI-9
DEPARTMENT OF BOTANY
BACHELOR OF SCIENCE IN BOTANY
COURSE STRUCTURE (w.e.f 2011-12 batch onwards)

SEMESTER -I

| Code No. | Subject | Contact Hrs/ Week | Credits | Total No. Of Hrs Allotted | Max Marks CA | Max Marks SE | Total |
|------------|---|-------------------|---------|---------------------------|--------------|--------------|-------|
| P111 | Part I Tamil | 6 | 3 | 90 | 25 | 75 | 100 |
| P211 | Part II English | 6 | 3 | 90 | 25 | 75 | 100 |
| MB11 | Core Paper -1 Algae,Fungi.Lichen & Bryophytes | 4+2 | 5 | 90 | 25 | 75 | 100 |
| MB12 | Core Paper 2: Pteridophytes, Gymnosperms and Palaeobotany | 4+2 | 5 | 90 | 25 | 75 | 100 |
| ESB11(F/P) | Skill based Elective -1: Food Preservation/ Plants of Economic importance | 2 | 2 | 30 | 15 | 35 | 50 |
| ESB12(B/O) | Skill based elective -2: Biofertilizer/Organic farming | 2 | 2 | 30 | 15 | 35 | 50 |
| ES | Environmental studies | 2 | 2 | 30 | 15 | 35 | 50 |
| | Total | 30 | 22 | 450 | | | |

SEMESTER -II

| Code No. | Subject | Contact Hrs/ Week | Credits | Total No. Of Hrs Allotted | Max Marks CA | Max Marks SE | Total |
|------------|---|-------------------|---------|---------------------------|--------------|--------------|-------|
| P121 | Part I Tamil | 6 | 3 | 90 | 25 | 75 | 100 |
| P221 | Part II English | 6 | 3 | 90 | 25 | 75 | 100 |
| MB21 | Core Paper -3 Microbiology and plant pathology | 4+2 | 4 | 90 | 25 | 75 | 100 |
| MB22 | Core Paper 4: Anatomy and Embryology of Angiosperm | 4+2 | 4 | 90 | 25 | 75 | 100 |
| ESB21(P/T) | Skill based Elective -3: Plant Tissue culture/Techniques in Plant Biology | 2 | 2 | 30 | 15 | 35 | 50 |
| ESB22(B/A) | Skill based elective -4: Bioremediation /Applied Ecology | 2 | 2 | 30 | 15 | 35 | 50 |
| VE | Human Rights and Value Education | 2 | 2 | 30 | 15 | 35 | 50 |
| MBL21 | Core Practical I –(for MB11,MB12,MB21 & MB22) | | 8 | | 40 | 60 | 100 |
| | Total | 30 | 28 | 450 | | | |

SEMESTER –III

| Code No. | Subject | Contact Hrs/ Week | Credits | Total No. Of Hrs Allotted | Max Marks CA | Max Marks SE | Total |
|------------|---|-------------------|---------|---------------------------|--------------|--------------|-------|
| P131 | Part I Tamil | 6 | 3 | 90 | 25 | 75 | 100 |
| P231 | Part II English | 6 | 3 | 90 | 25 | 75 | 100 |
| MB31 | Core Paper -5 Morphology and Taxonomy of Angiosperm | 3+2 | 4 | 75 | 25 | 75 | 100 |
| EMB31(M) | Elective paper- I Medicinal plants | 5 | 3 | 75 | 25 | 75 | 100 |
| ENB31(G/F) | Non-major Elective –I Gardening / Food Preservation | 2 | 2 | 30 | 15 | 35 | 50 |
| AB31(C) | Allied –Chemistry Anci. | 4+2 | 4 | 90 | 25 | 75 | 100 |
| | Total | 30 | 19 | 450 | | | |

SEMESTER –IV

| Code No. | Subject | Contact Hrs/ Week | Credits | Total No. Of Hrs Allotted | Max Marks CA | Max Marks SE | Total |
|------------|--|-------------------|---------|---------------------------|--------------|--------------|-------|
| P141 | Part I Tamil | 6 | 3 | 90 | 25 | 75 | 100 |
| P241 | Part II English | 6 | 3 | 90 | 25 | 75 | 100 |
| MB41 | Core Paper -6 Instrumentation and Computer Application | 3+2 | 4 | 75 | 25 | 75 | 100 |
| EMB41(B) | Elective Paper-2 Biodiversity and Conservation | 5 | 3 | 75 | 25 | 75 | 100 |
| ENB41(C/M) | Non-major Elective-2: Commercial Plant products/Mushroom cultivation | 2 | 2 | 30 | 15 | 35 | 50 |
| MBL41 | Core Practical 2 –(for MB31 & MB41) | | 4 | | 40 | 60 | 100 |
| AB41(C) | Allied –Chemistry Anci. | 4+2 | 4 | 90 | 25 | 75 | 100 |
| ABL41(C) | Allied Practical (for AB31(C) & AB41(C)) | | 2 | | 25 | 75 | 100 |
| | Total | 30 | 25 | 450 | | | |

SEMESTER –V

| Code No. | Subject | Contact Hrs/ Week | Credits | Total No. Of Hrs Allotted | Max Marks CA | Max Marks SE | Total |
|------------|---|-------------------|---------|---------------------------|--------------|--------------|-------|
| MB51 | Core Paper -7 Genetics, Evolution and Biostatistics | 4+4 | 5 | 120 | 25 | 75 | 100 |
| MB52 | Core Paper-8 Cell Biology and Biochemistry | 5+4 | 5 | 135 | 25 | 75 | 100 |
| EMB51(H) | Elective-3 Horticulture | 5 | 3 | 75 | 25 | 75 | 100 |
| ENB51(F/S) | Skill based Elective-6 Forestry/Silviculture | 2 | 2 | 30 | 15 | 35 | 50 |
| MBL51 | Core Practical-3 (for MB51 & MB52) | | 4 | | 40 | 60 | 100 |
| AB51(Z) | Allied- Zoology Anci. | 4+2 | 4 | 90 | 25 | 75 | 100 |
| | Self-study paper – Botanical World | | | | 15 | 35 | 50 |
| | Total | 30 | 23 | 450 | | | |

SEMESTER –VI

| Code No. | Subject | Contact Hrs/ Week | Credits | Total No. Of Hrs Allotted | Max Marks CA | Max Marks SE | Total |
|------------|---|-------------------|---------|---------------------------|--------------|--------------|-------|
| MB61 | Core Paper -9 Plant Physiology | 6+6 | 5 | 180 | 25 | 75 | 100 |
| MB62 | Core Paper -10 Biotechnology | 6+4 | 5 | 150 | 25 | 75 | 100 |
| ESB61(E/M) | Skill based Elective-6 Environmental Biotechnology/Marine Biotechnology | 2 | 2 | 30 | 15 | 35 | 50 |
| MBL61 | Core Practical 4 –(for MB61 & MB62) | | 4 | | 40 | 60 | 100 |
| AB61(Z) | Allied –Zoology Anci. | 4+2 | 4 | 90 | 25 | 75 | 100 |
| ABL61(Z) | Allied Practical (for AB51(Z) & AB61(Z)) | | 2 | | 25 | 75 | 100 |
| | Part-V Extension activities | | 1 | | | | |
| | Total | 30 | 23 | 450 | | | |

A) Consolidation of Contact Hours and Credits: UG Botany

| Semester | Contact Hrs / Week | Credits |
|----------|--------------------|---------|
| I | 30 | 22 |
| II | 30 | 28 |
| III | 30 | 19 |
| IV | 30 | 25 |
| V | 30 | 23 |
| VI | 30 | 22 |
| Part V | | 01 |
| Total | 180 | 140 |

B) Curriculum Credits : Partwise

Part ITamil(4 x 3 = 12).....12 Credits
 Part IIEnglish...(4 x 3 = 12).....12 Credits

Part III

Core.....(10+[8+8]+4+[4+4]+[10+4]+[10+4] = 66 Credits

Allied.....Chem. 4+ [2+4] + IMB 4+ [2+4] =20 Credits

Elective3+3+3 = 9 Credits

Part IV

Non major Eletive 2+2= 4Credits

Skill based Elective 4+4+2+2.....= 12Credits

Value Education= 2 Credits

Environmental Studies=.2 Credits

Part V

..... = 1 Credits

Total = 140 credits

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DEPARTMENT OF BOTANY
(from 2011-12 batch onwards)

| | | |
|--|----------------------|--------|
| Course: B.Sc., Botany | Code No | : MB11 |
| Semester: 1 | No. of Hrs allotted: | 90 |
| Paper: Core | No. of Credits | : 5 |
| Title of the Paper: ALGAE, FUNGI, LICHEN AND BRYOPHYTES | | |
| Marks : 25 + 75 = 100 | | |

Course Objectives:

1. To learn about the Cryptogamic plants.
2. To understand the diversity, complexity and the economic value of lower plants.

Unit I:

General classification of Algae based on Fritsch system – General characters of Blue-green Algae - *Nostoc* – Occurrence – structure of *Nostoc* colony – Cell structure – Heterocyst structure and function - Reproduction – Vegetative reproduction – Asexual reproduction – Hormogones, Endospores and Akinetes - Life cycle of *Nostoc*.

General characters of Green algae – *Caulerpa* – Thallus structure – Internal structure – Reproduction – Vegetative reproduction – Sexual reproduction - Diplontic Life cycle of *Caulerpa*

Unit –II

General characters of Brown algae – *Padina* – Occurrence - Thallus structure – Internal structure – Reproduction – Vegetative, asexual and sexual reproduction – Isomorphic Diplohaplontic Life cycle of *Padina*. General characters of Red algae – *Polysiphonia* – Occurrence - Thallus structure – cell structure – Reproduction – Vegetative, asexual and sexual reproduction – triphasic and diplobiontic Life cycle of *Polysiphonia*. Economic importance of Algae.

Unit III:

General Classification of Fungi based on Alexopoulos system – General characters of Oomycetes – *Saprolegnia* - Occurrence – somatic structure – vegetative reproduction – Asexual reproduction – phenomenon of diplanetism – Sexual reproduction – Life cycle of *Saprolegnia*. General characters of Ascomycetes – *Aspergillus* - Occurrence – somatic structure – Asexual reproduction – Sexual reproduction – Life cycle of *Aspergillus*. General Characters of Zygomycetes – *Rhizopus* - occurrence – somatic structure – Asexual reproduction – Sexual reproduction – Life cycle of *Rhizopus*. General characters of Basidiomycetes – *Agaricus* - Occurrence – Mycelium – Asexual reproduction – Sexual reproduction – Mature fruiting body (sporophore) – Anatomy of the fruiting body – development of the Basidium – discharge and germination of Basidiospores - Life cycle of *Agaricus*.

Unit IV:

General characters of Deuteromycetes – *Fusarium* - Occurrence – vegetative structure - Mycelium – Asexual reproduction. -Economic importance of Fungi. Lichens:-Morphology of the thallus – crustose, foliose, and fruticose – Fungal components - 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 Rothmaler - *Marchantia* – Occurrence –external features of adult gametophyte – Internal structure – Reproduction - Asexual reproduction – structure of Gemma – Sexual reproduction – structure of Antheridiophore and Archegoniophore – Sporophyte structure – Life history. (Development of sex organs excluded)

Text Books:

1. Steven L. Stephenson. 2010. The Kingdom fungi: The Biology of Mushroom, Molds and Lichens.
Timber Press Inc,UK. 272 pp
2. Lynda Ed. West. West 2010. Algae. Cambridge Uni. Press. UK 364 pp.
3. Vashishta, B.R. 1988. Bryophyta, 6th Edition, S.Chand and company, (Pvt.) Ltd., New Delhi.

Books for Reference :

1. G.S. West. 2010. Algae vol.I. Myxophyceae, Peridinieae, Bacillarieae, Chlorophyceae,
Cambridge Botanical hand book series. U.K. 490 pp..
2. Zoltan Tuba. Nancy g. Sleck. Lloyd. R. Stark. 2011. Bryophyte. Cambridge University Press.
U.K. 528 pp..
3. H.C. Dube. 2009. Introduction to Fungi. Vikas publishing pvt. Ltd. New Delhi. 210 pp..
4. Surindara Paracer, Vernon Ahmadjian. 2000. Symbiosis. Oxford University Press. 291 pp..

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Course: B.Sc., Botany

Code No : MB12

Semester: 1

No. of Hrs allotted: 90

Paper: Core

No. of Credits : 5

Marks: 25 + 75 = 100

Title of the Paper: **PTERIDOPHYTES, GYMNOSPERMS & PALAEOBOTANY**

Course Objectives:

- to understand the classification of Pteridophytes and Gymnosperms
- to identify the various forms of Pteridophytes
- to differentiate various members of Gymnosperms
- to know the fossil forms

UNIT – I

General characters of Pteridophytes – classification of Pteridophytes according to G.M. Smith – Stellar evolution - structure and reproduction of the following types (need not study the development of sex organs, gametophyte and sporophyte). *Psilotum* and *Lycopodium*.

UNIT – II

Structure and reproduction of the following types (need not study the development of sex organs, gametophyte and sporophyte). *Equisetum*, *Marsilea*, *Azolla* Economic importance of Pteridophytes.

UNIT - III

Geological era, brief account of process of fossilization. Structure and reproduction of the following fossil types.

Rhynia, *Lepidodendron* and *Sphenophyllum*.

UNIT - IV

General characters of Gymnosperms - classification of gymnosperms according to K.R. Sporne. Structure and reproduction of *Pinus* (developmental aspects need not be discussed).

Unit V

Structure and reproduction of *Gnetum* (developmental aspects need not be discussed).

Economic importance of Gymnosperms.

Text Books:

1. Parihar, N.S. 1965. An Introduction to Embryophyta Vol. I., Central Book Depot, Allahabad.
2. Sporne, K.R. 1974. Morphology of Gymnosperms, B.I. Publications, Chennai.
3. Sporne, K.R. 1976. Morphology of Pteridophytes, B.I. Publications, Chennai.
4. Vashishta, P.C. 1976. Gymnosperms, S.Chand and Co., New Delhi.
5. Vashishta, P.C. 1976. Pteridophytes, S.Chand and Co., New Delhi.
6. Pandey, B.P. 2001. College Botany Vol. II, S.Chand and Co., New Delhi.

Books for Reference

1. Alan Reid Smith. 1981. Pteridophytes. California Academy of Sciences. 370 pp.
2. S.M. Reddy, S.J. Chary. 2003. Gymnosperms. New age international (p) Ltd. Publisher. New Delhi. 452pp.
3. R. A. Spiler. Barry A. Thomas. 1986. Systematics & Taxonomic approaches in Palaeobotany. Clarendon Press. U.K. 321 pp.

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Course: B.Sc., Botany

Code No : ESB11(F)

Semester: 1

No. of Hrs : 30

Paper: Skill based Elective 1

No. of Credits: 2

Title of the Paper: **FOOD PRESERVATION**

Marks: 15 + 35 = 50

Course objectives:

- to know various food product
- to familiar with the preservation and processing of various food product
- to acquaint themselves with the quality assessment of food products
- know the methods of preparation of jams, jellies and other food

Unit – I

Introduction to food microbiology – unit operations in food processing. - Methods of food preservation: Dehydration, Osmotic preservation, Heat and cold preservation – processing of vegetables, fruits, Egg powder, meat, pickles, jams, jellies, squash and ketchup .

Unit - II

Milk production practices – quality control tests – milk processing sequences – clarification - pasteurization – homogenization. Milk products – Cheese and indigenous milk products. Sweetened, condensed and evaporated milk – Ice cream processing.

Text Books:

1. Dennis, R., Heldman and Richard. W. Hartel, 1996. Principles of Food Processing, First Edition, CBS Publishers, New Delhi.
2. Arthy, D. and Arhurst, P. 1995. Fruit Processing, Chapman & Hall, New Delhi.

Books for Reference:

1. Potter, N. 2003. Food Science, Fifth Edition, CBS Publishers, New Delhi.
2. Frazier, W.C and Westhoff, D.C. 1989. Food Microbiology, Eight Edition, Tata Mc Graw Hill Publications, New Delhi.

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Course: B.Sc., Botany

Code No : ESB11(P)

Semester: 1

No. of Hrs allotted: 30

Paper: Skill based Elective 1

No. of Credits : 2

Title of the Paper: **PLANTS OF ECONOMIC IMPORTANCE**

Marks : 15 + 35 = 50

Course objectives

- To acquire the basic knowledge for understanding the economic importance of plants.
- To understand the plants and plant products of Industrial value.

Unit I:

Food (cereals, millets, pulses, vegetables and fruits), Timber (teak, rosewood, sandal), Fibre (cotton, jute), oil (sunflower oil, castor oil, palm oil), Latex (*Hevea* and *Ficus elastica*), Medicine (Tulsi, Pepper, Ginger, *Eucalyptus*, Kilanelli and Turmeric)

Unit II:

Fibres and Fibre-yielding Plants – Wood and Cork – Tannins and Dyes – Rubber and its products – Pulp and Paper – Gums and Resins – Spices and Condiments -

Text books:

1. Pandey, B.P.1980. Economic Botany, S. Chand and Co., New Delhi.
2. Sambamurthy, A.V.S.S. and Subramanian, M.S. 1989. A Text book of Economic Botany, Wiley Eastern, New Delhi.

Books for Reference:

1. Larson, Donald W.. "Economic Importance of Plants." Plant Sciences. 2001. *Encyclopedia.com*.

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| | | |
|---|----------------------|--------------|
| Course: B.Sc., Botany | Code No | : ESB12(B) |
| Semester: 1 | No. of Hrs allotted: | 30 |
| Paper: Skill based Elective 2 | No. of Credits | : 2 |
| Title of the Paper: BIOFERTILIZERS | Marks: | 15 + 35 = 50 |

Course Objectives:

1. To know the importance of biofertilizers on crop productivity.
2. To understand the methods of isolation and inoculation of biofertilizers.

Unit I.

Role of chemical and organic fertilizers-need of biofertilizers. Symbiotic bacterial inoculants: *Rhizobium* – isolation, identification, mass multiplication and its agronomic importance. Non-symbiotic bacterial inoculants: *Azotobacter* and *Azospirillum* - isolation, identification, mass multiplication and its agronomic importance.

Unit 2.

Blue-green algal inoculants: - Isolation, cultivation, mass multiplication- Algalization and rice yields – persistence of the inoculum in the soil. Mass cultivation of *Azolla*: Chinese and Indian methods – application methods. Mycorrhizal inoculants: Types- Ecto and Endo mycorrhizae- mass multiplication. Inoculum production and application. Role of mycorrhizae in agriculture. Phosphate solubilizing bacteria-isolation and mechanism of P-solubilization.

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 Co. Pvt. Ltd., New Delhi.

Books for Reference :

1. Subba Rao, N.S. 1982. Advances in Agricultural Microbiology, Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi.
2. Venkataraman, G.S. 1972. Algal Biofertilizers and Rice cultivation,
Today and Tomorrow printers and Publishers, New Delhi.

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| | |
|--|--------------------------|
| Course : B.Sc., Botany | Code No : ESB12(O) |
| Semester: 1 | No. of Hrs allotted : 30 |
| Paper : Skill based Elective 2 | No. of Credits : 2 |
| Title of the Paper: ORGANIC FARMING | Marks : 15 + 35 = 50 |

Course objectives:

- To understand the merits of Organic Farming
- To appreciate the beneficial uses of Organic manures.
- To evaluate the response of crops to various organic manures

Unit – I

Green revolution and use of chemicals in agriculture – its impact on environment-human-animals.
Organic farming and its advantages. Organic manure: Farmyard manure-Green manure-Vermi compost – Vermi wash.

Unit-II

Bioprotectors: Production and application of *Trichoderma* – *Pseudomonas fluorescens*.

Biopesticides: Production and application of

- 1) Bacteria, *Bacillus thuringiensis*.
- 2) Fungi, *Beauveria bassiana* (Metarhizium),
- 3) Virus, NPV.

Bioenhancers: Preparations and applications of Effective Microorganisms(EM)-

- 1) Panchagavya
- 2) Fish Gunabajalam

Text Books:

1. Nirmala,C.B., G. Rajalakshmi, Chandra Karthick. 2009. Plant Biotechnology. MJP publishers,Chennai
2. Ramawat,K.G. 2000. Plant Biotechnology. Chand & co., New Delhi.

Books for Reference :

1. Subba Rao, N.S. 1998. Biofertilizers in Agriculture and Forestry Oxford & IBH publishing co. Pvt. Ltd. New Delhi.
2. Tilak, K.V.B.R. 1991. Bacterial biofertilizers, Indian council for Agricultural Research, New Delhi.

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DEPARTMENT OF BOTANY

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Course : B.Sc., Botany

Semester : 1

Paper : ES

Title of the Paper: **ENVIRONMENTAL STUDIES**

Code No : ES

No. of Hrs allotted: 30

No. of Credits : 2

Marks: 15 + 35 = 50

Course objectives:

- to understand the structure and functions of ecosystem
- to understand the sources, effects and control measures of various types of pollutants
- to know the phytoremediation of environment

Unit-I

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

Unit-II

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

Text Books:

1. Yogendra N. Srivastava, Environmental Pollution, Ashish Publishing House. 1998.
2. Kanagasabai C.S. Environmental Studies. Rasee publishers. 2005

Books for Reference:

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

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Course: B.Sc., Botany

Code No : MB21

Semester: 2

No. of Hrs allotted: 90

Paper: Core -3

No. of Credits : 4

Title of the Paper: **MICROBIOLOGY AND PLANT PATHOLOGY**

Marks: 25 + 75 = 100

Unit I

Introduction to Microbiology - Types of microorganisms –Salient features- Algae, Fungi, Protozoa, Bacteria, Viruses and Mycoplasma Prions. Major groups of bacteria as per Bergey's Manual of systematic Bacteriology 8th edition.

Unit II

Morphology and fine structure of bacteria – Nutritional types of bacteria – Growth: sigmoid growth, factors affecting growth - Reproduction of bacteria: Binary fission. Methods of recombination: Conjugation, Transduction and Transformation. Bacterial virus: Structure and reproduction of T4 Phage – Plant virus: TMV . Structure and multiplication .

Unit III

Types of culture media - Preparation of Course Objectives:

1. To learn the basic techniques involved in the isolation and cultivation of microbes.
2. To enable the students to identify microorganisms by cultural characteristics and staining procedure.
3. To appreciate the importance of microbes to human beings.
4. To learn the etiology, symptoms and transmission of plant diseases.

culture media – sterilization methods – pure culture technique – Staining: Simple staining and Gram staining – flagellar staining-Capsular staining. Preservation of microbial cultures.

Unit IV

Classification of plant diseases based on Host, Pathogen and Symptoms -Entry of the pathogen (Primary infection). Establishment of the pathogen (Enzymes and toxin) –Defense mechanism (structural and biochemical).

Unit V

Study of the following diseases with reference to causal organism, symptoms , dissemination and control

1. Early and Late leaf spot of ground nut.
2. Citrus Canker.
3. Brinjal little leaf.
4. Bhendi yellow vein mosaic
5. Root knot disease in Tomato.
6. Red rust of tea

Text Books:

1. Mehrotra, R.S., 1980. Plant Pathology, Tata McGraw-Hill pub. company Ltd, New Delhi
2. Aneja, K.R. 1996. Experiments in Microbiology, Plant pathology. Tissue culture and Mushroom cultivation. Wishwa Prakashan, (New Age International (p) Ltd), New Delhi.
3. Pandey, B.P.,1997. Plant pathology. S.Chand and Co.,New Delhi.
4. Ananthanarayan,R and C.K. Jayaram Paniker .1996. Text book of Microbiology. Orient Longman , Hyderabad.

Books for Reference

1. Pelczar, M.J., Chan, E.C.S, Krieg, N.R. 1993. Microbiology – Concepts and Applications, McGraw-Hill,Inc., New York.
2. Prescott,L.M.,Harley,J.P.and Klein,D.A.2002. Microbiology.McGraw-Hill companies, Inc.,New York.

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Course: B.Sc., Botany

Code No : MB22

Semester: 2

No. of Hrs allotted: 90

Paper: Core -4

No. of Credits : 4

Title of the Paper: **ANATOMY AND EMBRYOLOGY OF ANGIOSPERMS**

Marks: 25 + 75 = 100

Course Objectives:

1. To know about the internal structure and organization of the various parts of the plants – stem, root and leaves.
2. To understand the changes leading to the development of embryo in dicots and monocots.
3. To appreciate the various aspects in experimental embryology.

Unit I

Meristematic tissue – characteristics, types and theories related to meristem – Root apex: histogen theory, Korpe Kappe theory. Shoot apex: Apical cell theory, Histogen theory, Tunica Corpus theory. Structure, types and functions of Permanent tissues: Simple tissues-Parenchyma, Collenchyma and Sclerenchyma. Complex tissues- xylem and Phloem.

Unit II

Primary structure of the following: Dicot root-*Vigna*, Monocot root-Maize. Dicot stem-*Helianthus*, Monocot stem-*Maize*, Leaf Anatomy: Dicot leaf-*Tridax*, Monocot leaf-*Polyanthus*. Nodal Anatomy: Unilacunar node-*Polyalthia*, Trilacunar node - *Azadirachta*, Multilacunar node - *Aralium*. Stomatal types.

Unit III

Secondary growth: Normal secondary growth in dicot root-*Cicer*, dicot stem – *Tecoma*. Anomalous secondary growth – *Boerhaavia*, and Monocot stem-*Dracaena*.

Unit IV

Structure and development of Microsporangium-Microsporogenesis: Development of male gametophyte. Structure and development of Megasporangium, Types of Ovule. Megaspороgenesis: Development of female gametophyte.

Unit V

Fertilization: Process and significance of double fertilization, types of fertilization. (Porogamy, Chalazogamy and Mesogamy), Post-fertilization changes. Endosperm: Types – Nuclear, Cellular and Helobial. Embryo: Structure and development- Dicot embryo- *Capsella*, Monocot embryo-*Luzula*. –Polyembryony.

Text Books:

1. Vashista, P.C. 1986. Plant Anatomy, Pradeep Publications, Jalandhar.
2. Pandey, S.N. and Chadha, A. 1996. Plant Anatomy and Embryology. Vikas Pub. House Ltd, New Delhi.
3. Bhojwani, S.S. and Bhatnagar, S.P., 1992. The Embryology of Angiosperms, Vikas Publishing House , New Delhi.

Reference Books:

1. Maheswari, P. 1950. An Introduction to the Embryology of Angiosperms, Vikas Publishing House, New Delhi.
2. Prakash, E.J.J. 1987. A Text Book of Plant Anatomy, EmKay Publications, New Delhi.

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Course: B.Sc., Botany

Code No : ESB21(P)

Semester: 2

No. of Hrs allotted: 30

Paper: Skill based Elective -3

No. of Credits : 2

Title of the Paper: **PLANT TISSUE CULTURE**

Marks: 15 + 35 = 50

Objectives:

1. To learn the techniques for plant tissue culture
2. To understand the *in vitro* propagation techniques

Unit- I

Plant tissue culture techniques – Totipotency – Callus - organogenesis – role of plant growth regulators - applications; somatic embryogenesis – artificial seeds – applications; micropropagation – culture conditions – hardening – applications.

Unit- II

Production of secondary metabolites- role of suspension culture – culture conditions – applications ; transgenic plants – methods and productions of herbicide resistant plants ; role of plant tissue culture on germplasm conservation.

Text Books:

1. Smith, R.H. 2000, Plant tissue culture-Techniques and Experiments, Academic Press, California.
2. Dwivedi, P. 2004, Plant Tissue culture, Scientific Publishers, India.
3. Gamborg O.L. (Ed.) Phillips (2004). Plant cell, Tissue and Organ culture, Narosa publishing house. New Delhi.

Reference Books:

1. Reinert, J., and Bajaj, Y.P.S., 1977, Plant Cell, Tissue and Organ Culture, Narosha Publishing House, New Delhi.
2. Dubey, R.C., 2000. A Text Book of Biotechnology, New Delhi.

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|--|----------------------|--------------|
| Course: B.Sc., Botany | Code | : ESB21(T) |
| Semester: 2 | No. of Hrs allotted: | 30 |
| Paper: Skill based Elective -3 | No. of Credits | : 2 |
| Title of the Paper: TECHNIQUES IN PLANT BIOLOGY | Marks: | 15 + 35 = 50 |

Objectives:

1. To understand the principles and applications of classical and modern techniques in biology
2. To develop skills in operation of modern equipments/instruments

Unit- I

Electrophoresis: SDS – PAGE of protein and Agarose gel electrophoresis of nucleic acids.

Antigen-antibody, types and reactions, Monoclonal antibody – production and application, ELISA and its application

Unit- II

Blotting techniques: Types of blotting, procedures involved in Southern, Northern blotting and Western blotting, Detection – dyes used for detection of nucleic acids in Electrophoresis.

Text Books:

1. Plummer, D.T. 1979. An Introduction to Practical Biochemistry. Tata McGraw Hill Co., Mumbai.
2. Palanivelu, P. 2000. Laboratory manual for a analytical biochemistry and separation techniques, School of Biotechnology, Madurai.

Reference Books:

1. Keith Wilson and John Walker. 1995. Practical Biochemistry, University of Cambridge, New Your.

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|---|---------------------|------------|
| Course: B.Sc., Botany | Code No | : ESB22(B) |
| Semester: 2 | No. of Hrs allotted | : 30 |
| Paper: Skill based Elective -4 | No. of Credits | : 2 |
| Title of the Paper: BIOREMEDIATION | Marks: 15 + 35 = 50 | |

Course Objectives:

1. To know the causes and factors influencing Xenobiotics in the environment.
2. To learn the principles of Bioremediation.

Unit-I Environmental pollutants-recalcitrant compounds and xenobiotics-Bioremediation-types-factors affecting –mechanisms of bioremediation-Microbial bioremediation *in situ* and *ex situ* remediation techniques. Bioremediation of heavy metal.

Unit-II Biodegradation of xenobiotics:Hydrocarbons-aliphatic,aromatic,pohycyclic aromatic hydrocarbons- Pesticide degradation-Degradation of dyes. Microbial degradation of oil-Lignin degradation-Biological treatment of sewage and industrial effluents -Solid waste disposal-Composting.

Text Books:

1. Rajendran, P. and P. Gunasekaran 2006. microbial bioremediation MJP publishers, Chennai.
2. Dubey,R.C.2002. A textbook of Biotechnology.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, New Delhi.

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Course: B.Sc., Botany

Semester: 2

Paper: Skill based Elective -4

Title of the Paper: **APPLIED ECOLOGY**

Code No : ESB22(A)

No. of Hrs allotted: 30

No. of Credits: 2

Marks: 15 + 35 = 50

Course Objective:

to study natural disaster and their management.

to study wild life management

Unit-1

Disaster Management – Objectives. Natural disaster - types and management of flood, cyclone, earthquake and Tsunami. Sustainable management : Aim and measures to be taken – Water management : Rain water harvesting and watershed management.

Unit-2

Wild life management in India – reasons for depletion of wild life; necessity of wild life conservation; modes of wild life conservation; protection by law, protected species of Indian wild life, Establishment of sanctuaries and national parks.

Text Books:

1. Agarwal, K.C., 1989, Environmental Biology, Agro Botanical Publishers, Delhi.
2. Verma, P.S and V.K. Agarwal. 1983. Environmental Biology, S. Chand & Co. Ltd. New Delhi.
3. Ananthkrishnan, T.N., 1987, Bioresources Ecology, Oxford and IBH, New Delhi.

Reference Books:

1. De, A.K., 1994, Environmental Chemistry, New Age International Pvt.Ltd., Delhi.
2. Sharma, B.K. and Kaur, H., 1998, Environmental Chemistry, Goel Publishing House, Meerut.
3. Subrahmanyam, N.S. and Sambamurthy, A.V.S., 2001, Ecology, Narosa Publishing House, New Delhi.

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Course: B.Sc., Botany

Code No : VE

Semester: 2

No. of Hrs allotted: 30

Paper: VE

No. of Credits: 2

Title of the Paper: **HUMAN RIGHTS AND VALUE EDUCATION**

Marks: 15 + 35 = 50

Course Objective: To learn Human Rights and meaning of value education.

Unit –I

Meaning of Human rights-Evolution of Human rights-Types of Human rights-Civil, Political, Economical, Social and Cultural. Human rights in India. Outstanding features of our constitution. Preamble-Fundamental rights. Directive Principles of State Policy. Fundamental duties. Consumer rights in India.

Unit-II

Meaning of Value education-Objectives of Value Education. Need and importance. Goals of Education and life. Ethics and Culture. Good habits. Role of Educational Institutions.

Text Books:

1. National Council for Teacher Education, Human rights and National values, Self learning module, Volumes I-III New Delhi. 1996.
2. Agarwal, H.O. Implementation of Human Rights Conventions with special reference to India. Allahabad, Kitab Mahal.1983.
3. Borgohain and Bani: Social Justice and Political change, Kanishka publishers. 1999.

Books for References:

4. Jayapalan. N. Human Rights, Atlantic publishers, New Delhi. 2000.
5. Nirmal. C.J. Human rights in India, Oxford Press. New Delhi.1999.

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Course: B.Sc., Botany

Code No : MBL21

Semester: 2

No. of Hrs allotted: 120

Paper: Core Practical -1

No. of Credits: 8

Title of the Paper: –(for MB11,MB12,MB21 & MB22)

Marks: 40 + 60 = 100

ALGAE, FUNGI, LICHENS & BRYOPHYTES -Lab Course - Contact Hours per week: 2.

1. Study of the macroscopic seaweeds: Chlorophyceae-*Caulerpa*: Morphological variations and anatomical
2. Study of the coenocytic thallus and rhizome. Study of the macroscopic seaweeds: Phaeophyceae-*Padina*: a) Morphology of macroscopic thallus and gametangium, b) anatomical study of sporophyte.
3. Study of morphology of algae: Rhodophyceae-*Polysiphonia*: gametophyte, sporophyte and Cystocarp
4. Identification and micropreparation of *Saprolegnia*, *Rhizopus* & *Aspergillus*
5. Identification and micropreparation of *Agaricus*, and *Fusarium*
6. Study of external morphology of *Parmelia* and *Usnea*, L. S. of Lichen Apothecium.
7. Study of external and internal structure of *Marchantia* thallus. Study of Antheridiophore, Archegoniophore and Sporophyte of *Marchantia*.

PTERIDOPHYTES, GYMNOSPERMS AND PALAEOBOTANY -Lab Course - Contact Hours per week:2

1. Study of the external and internal structure of *Psilotum* stem and structure of Synangium
2. Study of the external and internal structure of *Lycopodium* stem and structure of cone
3. Study of the external and internal structure of *Equisetum* stem and structure of cone
4. Study of the external and internal structure of *Gleichenia* rachis and structure of sorus
5. Study of the external and internal structure of *Marsilea* rhizome and petiole
6. Study of the external and internal structure of *Azolla* leaf and structure of sporocarp.
7. Study of the internal structure of *Pinus* stem and needle leaf. Study of the *Pinus* male and female cone.
8. Study of the internal structure of *Gnetum* stem. Study of the *Gnetum* male and female cone
9. Study of the fossil types: Study of the structure of *Lepidodendron* with the help of fossil slides
10. Study of the structure of *Lyginopteris* with the help of fossil slides.

MICROBIOLOGY AND PLANT PATHOLOGY -Lab Course - Contact Hours per week: 2

1. Preparation of culture media. Sterilization techniques. Inoculation and purification of microorganism-
Streak plate techniques.
2. Quantification of soil microbes by plating technique .
3. Motility of bacteria by hanging drop method.
4. Staining: simple staining and Gram staining; Fungal staining: Lacto phenol and cotton blue.
Fungal spore staining
5. Demonstration of fungal mounting.
6. Demonstration of acid and gas production technique by bacteria.
7. Study of diseased plant materials: Mildew and Brown Rust.
8. Study of diseased plant materials: Red rot and leaf spot of ground nut.
9. Study of diseased plant materials: Canker, Red rust and white rust.
10. Demonstration of the isolation of pathogen from diseased material.
11. Submission of 5 herbarium sheets of infected plant materials –valued externally.

ANATOMY AND EMBRYOLOGY - Lab Course - Contact Hours per week: 2

1. Study of the internal structure of Dicot root – Bean
2. Study of the internal structure of Monocot root - Maize
3. Study of the internal structure of dicot stem-Castor
4. Study of the internal structure of monocot stem-*Sorghum*
5. Study of the internal structure of dicot leaf- *Tridax*
6. Study of the internal structure of monocot leaf-*Polygonum*
7. Normal secondary growth: *Cicer* root
8. Normal secondary growth: *Tecoma* stem
9. Anomalous secondary growth: *Boerhaavia* stem
10. Anomalous secondary growth: *Dracaena* stem
11. Nodal Anatomy – *Polyalthia*, *Azadirachta*
12. Nodal Anatomy- *Aralium*
13. Different stages of Embryo mounting - *Tridax*
14. Structure of Anther-*Datura*
15. Ovule types

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Course: B.Sc., Botany

Code No : MB31

Semester: 3

No. of Hrs allotted: 75

Paper: Core Paper-5

No. of Credits : 4

Title of the Paper: **MORPHOLOGY AND TAXONOMY OF ANGIOSPERM**

Marks: 25 + 75 = 100

Course Objectives:

1. To know the local flora and to classify them systematically.
2. To learn 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

Binomial Nomenclature, Herbarium technique- Classification – Linnaeus-Bentham & Hooker-Engler and Prantl ; ICPN and its role, Botanical Survey of India (BSI).

Unit III

Study of the following families and their economic importance:-

1. Annonaceae
2. Capparidaceae
3. Rutaceae
4. Caesalpiniaceae
5. Cucurbitaceae

Unit IV

Study of the following families and their economic importance:-

6. Sapotaceae
7. Convolvulaceae
8. Asclepiadaceae
9. Acanthaceae
10. Lamiaceae

Unit V

Study of the following families and their economic importance:-

11. Amaranthaceae.
12. Nyctaginaceae
13. Orchidaceae
14. Amaryllidaceae
15. Poaceae.

Text Books:

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

Reference Books:

1. Rendle, A.B. 1904. The classification of flowering plants. Vol. I. Gymnosperms and Monocotyledons. Cambridge University Press. London.
2. Rendle, A.B. 1925. The classification of flowering plants. Vol II Dicotyledons. Cambridge University Press. London.

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Course: B.Sc., Botany

Code No : EMB31(M)

Semester: 3

No. of Hrs allotted: 75

Paper: Elective paper-1

No. of Credits: 3

Title of the Paper: **MEDICINAL PLANTS**

Marks: 25 + 75 = 100

Course Objectives:

1. To realize the significance of medicinal plants
2. To understand the medicinal importance of plants

UNIT-I

Classification of drugs based on morphological structures, pharmacological and chemical nature. Preparation of commercial drugs-A general account on collection, harvesting, drying, garbling and packing. Drug adulteration.

UNIT-II

Chemical nature of natural drugs: Brief study about general properties, classification, uses and chemical test for the following: Alkaloids, Terpenoids, Glycosides, Lipids, Volatile oils and tannins

UNIT-III

Various methods for the preparation of drugs- Juice, Paste, Extract, Infusion, Decoction, Mixture, Powder, Syrup, Fermentation and Medicated oil. Drugs from non-flowering plants: Sources and uses of the following:

1. Bryophyte-*Sphagnum*
2. Fern-*Adiantum*
3. Gymnosperm-*Pinus*.

UNIT-IV

Drugs from flowering plants:

Brief study about cultivation, constituents and uses of the following;

1. Root-*Withania somnifera*
2. Rhizome-*Zingiber officinale*
3. Leaves-*Adhatoda vasica*
4. Bark- *Alstonia scholaris*.

UNIT-V

Brief study about cultivation, constituents and uses of the following;

Flower-*Syzigium aromaticum*

Fruits- *Piper nigrum*

Seeds- *Ricinus communis*

Whole plant- *Phyllanthus amarus*

Text Books:

1. Kumar, N.C. 1993. An introduction to medical Botany and Pharmacognosy. Emkay publications, New Delhi.
2. Kokate, C.K, Purohit, A.P, Gokhale, C.B. 2003. Pharmacognosy Nirali prakashan, Pune.
3. Pal, D.C. and Jain, S.K. 1998. Tribal medicine, Naya prokash, Calcutta.

Reference Books:

1. Wallis, T.E. 1985. Text Book of Pharmacognosy. CBS publishers and Distributors, Delhi.
2. Mohammed Ali, 1998 Text Book of Pharmacognosy CBS publishers and Distributors, New Delhi.

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|--------------------------------------|----------------------|----------------|
| Course: B.Sc., Botany | Code No | : ENB31(G) |
| Semester: 3 | No. of Hrs allotted: | 30 |
| Paper: Non-major Elective -1 | No. of Credits | : 2 |
| Title of the Paper: GARDENING | Marks | : 15 + 35 = 50 |

Course Objectives:

1. To learn the basics of gardening and its techniques
2. To learn to occupy oneself during leisure time.
3. To use the space one has for productive purposes.

Unit-I

Ornamental garden and its components: Climbers and Creepers, Trees, Shrubs, Rock garden, Water garden, Hedges and Edges, Lawn, Flower beds, Path. Indoor Gardening: Choice of plants and maintenance, Bottle garden, Hanging pots, Bonsai: Techniques and Maintenance, Choice of plants. Kitchen garden: Importance, lay out and choice of plants.

Unit II

Techniques in Gardening:- Seed propagation (Direct sowing, Broadcasting). Separation or Division, Cuttage: leaf, stem and root cuttings- Layerage: Ground and Air layering –Graftage: Detached scion, Approach and repair grafting – Budding.

Text Books:

- 1.Rao,K.M. 1991. Textbook of Horticulture, MacMillan India Ltd., New Delhi
- 2.Vishnu Swarup. 1997. Ornamental Horticulture, MacMillan India Ltd, New Delhi.
- 3Chandha,K.L.2001.Handbook of Horticulture. ICAR Publications, New Delhi.

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Course: B.Sc., Botany

Code No : ENB31(F)

Semester: 3

No. of Hrs allotted: 30

Paper: Non-major Elective -1

No. of Credits : 2

Title of the Paper: **FOOD PRESERVATION**

Marks: 15 + 35 = 50

Course objectives:

- to know various food product
- to familiar with the preservation and processing of various food product
- to acquaint themselves with the quality assessment of food products
- know the methods of preparation of jams, jellies and other food

Unit – I

Introduction to food microbiology – unit operations in food processing. - Methods of food preservation: Heat and cold preservation and processing- Fruits, vegetables and meat – processing of fruits, vegetables and meat. Fermented foods – cheese, pickles, jams and jellies.

Unit - II

Milk production practices – quality control tests – milk processing sequences – clarification - pasteurization – homogenization. Milk products – Cheese and indigenous milk products. Sweetened, condensed and evaporated milk – Ice cream processing.

Text Books:

3. Dennis, R., Heldman and Richard. W. Hartel, 1996. Principles of Food Processing, First Edition, CBS Publishers, New Delhi.
4. Arthy, D. and Arhurst, P. 1995. Fruit Processing, Chapman & Hall, New Delhi.

Reference Books:

1. Potter, N. 2003. Food Science, Fifth Edition, CBS Publishers, New Delhi.
2. Frazier, W.C and Westhoff, D.C. 1989. Food Microbiology, Eight Edition, Tata Mc Graw Hill Publications, New Delhi.

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| | | |
|---|---------------------|--------|
| Course: B.Sc., Botany | Code No | : MB41 |
| Semester: 4 | No. of Hrs allotted | : 75 |
| Paper: Core paper-6 | No. of Credits | : 4 |
| Title of the Paper: INSTRUMENTATION AND COMPUTER APPLICATION | | |
| Marks: 25 + 75 = 100 | | |

Course Objectives:

1. To understand the various modern techniques.
2. To apply the principles of instrumentation in research.
3. To learn about the basics of computing, internet and literature search.
4. To understand the role of computer in biological research

Unit I:

Microscopy – Principles of Microscopy - Dark field , Phase contrast , Fluorescent microscopes.

Unit II

pH metry: p^H meter - operation of pH meter- Centrifugation – Basic principles of centrifugation – Ultracentrifuges Density gradient.

Unit III

Colorimetry: Beer-Lambert's Law – colorimeter – applications. Chromatography – Principles – paper chromatography and Thin layer chromatography.

Unit IV

Computer: Introduction – Organization of digital computer, Input/Output Devices – Storage devices, Memory.

Unit V

MS Office, Word, Excel and Power point, Internet. Basic principle and applications.

Text Books:

1. Jayaraman, J. 1992, Laboratory Manual in Biochemistry. Wiley Eastern Ltd., New Delhi.
2. Wilson, K & Goulding, K.H, 1992, A biological guide to Principles and Techniques in Practical biochemistry, Cambridge University Press, Cambridge, U.K.
3. Palanisamy, S. 1993, Principles of Biochemistry and Biotechniques. Palani Paramount Publications, Palani.
4. Plummer, D.T.1987. An Introduction to Practical Biochemistry. Tata McGraw- Hill Publishing Co. Ltd., New Delhi.
5. Suresh K. Pasandra 1997, Computer today. Galcotia Publications, New Delhi.
6. Krishnamurthy – Fundamentals of computer. Tata McGraw-Hill Publishing Company Ltd., New Delhi.
7. Sunkin, M.G. 1992. Introduction to Computer Information Systems for business. S.Chand & Co., New Delhi.

Reference Books:-

1. Mousumi – Debnath. 2005. Tools and Techniques of Biotechnology. Pointer publisher, Jaipur.
2. Taxali, R.K., 2000. PC Software for Windows – Made Simple (Tata McGraw-Hill publishing company Ltd., New Delhi).

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Course: B.Sc., Botany

Code No : EMB41(B)

Semester: 4

No. of Hrs allotted: 75

Paper: Elective Paper-2

No. of Credits : 3

Title of the Paper: **BIODIVERSITY AND CONSERVATION**

Marks: 25 + 75 = 100

Objectives:

1. To understand the concepts of Biodiversity and its applications
2. To make them aware and knowledge rich in biodiversity conservation

Unit - I

Introduction to Biodiversity – Categories – Species – Habitat and ecosystem – Biomes – Genetic Diversity – Biodiversity Hot spots – Biogeographic zones of India – Scope and Applications of Biodiversity study

Unit - II

Biodiversity values – Consumptive – Productive – Social – Ethical – Aesthetic – Option – Ethno botanical and Traditional knowledge values - Ecotourism – Ecosystem and its services

Unit – III

Threats to Biodiversity – Impacts – Habitat loss – Poaching of wildlife – Man and animal conflicts – Anthropogenic impacts – Exotic species introduction – GMOs

Unit - IV

Biodiversity conservation – In-situ principles – objectives – National Parks – Wildlife Reserves and Sanctuaries – Biosphere Reserves – Silent Valley and Gulf of Mannar – Project Tiger

Unit - V

Ex-situ conservation principles – Botanical gardens – Zoological Parks – Germplasm conservation – Basics of Plant tissue culture - Cryopreservation – Forest Act – Biodiversity Act

Text Books:

1. F.B. Mandal & N.C. Nandhi (2009), Biodiversity: Concept, Conservation and Biofuture Asian Books P. Ltd., New Delhi.
2. S.S. Purohit, Q.J. Shammi, A.K. Agarwal (2009) A Text Book of Environmental Sciences , Saraswathi Prohit for Student Edition, Jodhpur.
3. Mike J. Jeffries, Michael J. Jeffries (2005), Biodiversity and Conserveation Routledge Taylor & Francis Group, UK.
4. K.V. Krishnamoorthy (2004), Text Book of Biodiversity Science Publishers,
5. David William Pearce (1994), The economic value of biodiversity

Reference Books:

1. R.J.B.Daniels & J.Krishnamurthy 2009 Environmental Studies, Wiley India, New Delhi
2. Dan L. Perlman, Glenn Adelson (2007) Biodiversity: Exploring Values and Priorities in Conservation, Blackwell Publishers, UK
3. Peter Stiling (2002), Ecology Theories and Applications Prantice-Hall of India, New Delhi.
4. Dan. L. Perlman, Gleen. Adelson (1997), Biodiversity: Exploring values and priorities in conservation , Blackwell Publishers, UK.

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|--|----------------------|------------|
| Course: B.Sc., Botany | Code No | : ENB41(C) |
| Semester: 4 | No. of Hrs allotted: | 30 |
| Paper: Non-major Elective -2 | No. of Credits | : 2 |
| Title of the Paper: COMMERCIAL PLANT PRODUCTS | | |

Marks: 15 + 35 = 50

Objectives:

1. To Identify and explore the commercially important plant products
2. To train the students in production utilization and marketing of plant products.

Unit-1

Fibre and Coir products from plants- *Agave* and Banana; Basket and plate making from plant parts - Organic manure - Composting-Compost from organic waste; Bio-pesticide - Neem cake and Neem oil; Seaweed products - Agar, Alginates and Carrageenan.

Unit-II

Cultivation, Collection, Preservation and marketing of herbal products – *Andrographis paniculata*, *Asparagus racemosus*, *Cassia senna*, *Curcuma longa*, *Gymnema sylvestre* and *Adhatoda varica*. Spices – Rubber.

Text books:

1. Trivedi, P. C. 2001. Algal Biotechnology, Pointer publishers. India.
2. Sambamurthy, A.V.S.S and N.S. Subrahmanyam.1989. A Textbook of Economic Botany – Wiley Eastern Ltd. India.

Reference Books:

1. Kokate *et al.* 1994. Pharmacognosy. Nirali Prakashan.
2. Treas, G.E. and Evans, W.C. 1980. Text book of Pharmacognosy, ELBS, Bailliere, Tindall

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Course: B.Sc., Botany

Code No : ENB41(M)

Semester: 4

No. of Hrs allotted: 30

Paper: Non-major Elective -2

No. of Credits : 2

Title of the Paper: **MUSHROOM CULTIVATION**

Marks: 15 + 35 = 50

Objectives:

1. To understand the mushroom cultivation technique
2. To understand the importance of mushrooms as food and medicine

Unit- I

Edible, poisonous and medicinal mushrooms – Mushroom life – Morphology of commercially cultivated mushrooms, *Agaricus*, *Pleurotus* and *Ganoderma*. Nutritional and medicinal values of mushrooms – Applications of mushroom fungi in food, feed, enzyme and composting industries. Mushroom fungi culture media – PDA, MGYP media – Sterilization techniques – maintenance and storage of cultures.

Unit- II

Mushroom mother stock culture by tissue culture – Preparation of mother spawn and seed spawn – Mass cultivation techniques for *Agaricus* and *Pleurotus* mushrooms – Post harvest technology, preservation and storage of mushrooms. Problems in mushroom cultivation: pests, diseases, weed moulds and their control.

Text Books:

1. Nita Bahl. 1996. Handbook on Mushrooms. Oxford and IBH Publishing Co. Ltd. New Delhi. .
2. Kapoor, J.N. 1989. Mushroom Cultivation. ICAR, New Dellhi-12

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.

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|---|-------------------------|
| Course : B.Sc., Botany | Code No : MBL41 |
| Semester: 4 | No. of Hrs allotted: 60 |
| Paper: Core Practical -2 | No. of Credits : 4 |
| Title of the Paper: – (for MB31 & MB41) | Marks: 40 + 60 = 100 |

MORPHOLOGY & TAXONOMY OF ANGIOSPERMS -Lab Course - Contact Hours per week: 2

1. Various types of root modifications.
2. Modifications of stem: Aerial and Underground stem
3. Inflorescence types: Racemose, Cymose, Mixed and Special types of inflorescence
4. Fruit types: simple, aggregate and Multiple fruits
5. Identification and Description of families: Annonaceae and Capparidaceae
6. Identification and Description of family: Rutaceae
7. Identification and Description of families: Caesalpiniaceae and Cucurbitaceae
8. Identification and Description of family: Sapotaceae
9. Identification and Description of families: Asclepiadaceae and Convolvulaceae
10. Identification and Description of family: Acanthaceae
11. Identification and Description of families: Lamiaceae and Amaranthaceae
12. Identification and Description of families: Orchidaceae and Nyctaginaceae
13. Identification and Description of family: Amaryllidaceae
14. Identification and Description of family: Poaceae
15. Preparation of ten herbarium sheets of common plants.
16. Economic importance of some products as in theory syllabus.

BIOTECHNIQUES AND BASICS OF COMPUTER –Lab Course - Contact Hours per week: 2

1. Measurement of pH.
2. Preparation of Phosphate buffer.
3. Preparation of Citrate buffer.
4. Finding out the complementary colour of the given colour solution.
5. Verification of Beer's Law.
6. Paper chromatography-pigments separation.
7. MS Office – Word: a) Create a word document to display any four families. b) Load an image file for each family to display floral characteristics.
8. MS Office – Excel: worksheet Data entry and graph preparation;
9. Maths functions: sum, max, min, average.
10. Power point – Simple presentation – Sound effect – Animation.

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DEPARTMENT OF BOTANY
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| | | |
|--|----------------------|---------------|
| Course: B.Sc., Botany | Code No | : MB51 |
| Semester: 5 | No. of Hrs allotted: | 120 |
| Paper: Core -7 | No. of Credits | : 5 |
| Title of the Paper: GENETICS, EVOLUTION AND BIOSTATISTICS | Marks: | 25 + 75 = 100 |

Course Objectives:

1. To understand and apply the various concepts involved in Genetics
2. To acquire a firm foundation in the field of Genetics
3. To learn and appreciate the various concepts of evolution.
4. To have a clear-cut picture about the various statistical principles that can be used in their higher studies

Unit I:

Mendel's laws – Monohybrid crosses and law of segregation – Dihybrid crosses and Mendel's law of independent assortment - Back cross-Incomplete dominance – Interaction of Genes: Supplementary genes (9:3:4), Dominant Epistasis (12:3:1) Polygenic inheritance: Kernel colour in wheat, Ear length in Maize .

Unit II:

Difference in linkage and independent assortment; Morgan's views on linkage, kinds of linkage-complete linkage, incomplete linkage; linkage groups; Linkage groups in Maize. Significance of linkage. Mechanism and kinds of crossing over; synapsis; duplication of chromosome, Factors affecting crossing over. Significance of crossing over.

Unit III:

Sex determining mechanism – heterogametic males, heterogametic females, hormonally controlled sex determining mechanism. Sex-linked inheritance: Eye colour in *Drosophila*, Hemophilia. Sex-influenced inheritance – Baldness. Extra chromosomal inheritance: Uniparental inheritance in *Chlamydomonas reinhardtii*. Plastid colour in plants – coiling in snail .

Unit IV

Lamarck's theory of inheritance of acquired characters, Darwin's theory of natural selection, Mutation theory of Hugo de Vries, Synthetic theory of evolution.

Unit V

Biostatistics: Collection of data, classification of data, tabulation, graphic and diagrammatic presentation of data – Measures of central tendency: Mean, Mode and Median. Measures of dispersion – Range and standard deviation – Chi-square test.

Text Books:

1. Sarin, C.1989. Genetics, Tata McGraw-Hill Publishing company Ltd. New Delhi.
2. Palanichamy, S. Manoharan,M. 1994. Statistical methods for Biologists, Palani Paramount Publications, Tamil Nadu..
3. Dobzhansky,T., Ayala, F.J., Stebbins, G.L. and Valentine, J.W. 1973. Evolution, Surjeet Publications, Delhi.
4. Savage, J.M., 1976. Evolution, 2nd Ed., Amerind Pub. Co. Ltd., New Delhi.
5. C.C. Ainsworth. 2000. Sex determination plants. Bios Scientific publishers Ltd. 221 pp

Reference Books:

1. Strickberger, M.W., 1985. Genetics, 3rd Ed., MacMillan Publishing, New York.
2. Gupta,S.P. 1977. Statistical methods, 9th Ed. Sultan Chand and sons Publishers, New Delhi.
3. Leland Hartwell.Leroy Hood. Michael Goldberg. 2010. Genetics: From gene to Genomes. Mc-Grow-Hill Companies.Inc. 816 pp

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| | | |
|--|---------------------|--------|
| Course: B.Sc., Botany | Code No | : MB52 |
| Semester: 5 | No. of Hrs allotted | : 135 |
| Paper: Core -8 | No. of Credits | : 5 |
| Title of the Paper: CELL BIOLOGY AND BIOCHEMISTRY | Marks: 25 + 75 = | 100 |

Course Objectives:

1. To study the ultra structure of plant cell and organelles.
2. To introduce to the students, the structure and properties of various biomolecules.
3. To learn the various concepts involved in the mechanism of enzyme action.

Unit I

Ultra structure of plant cell: structure, chemical composition and function of cell wall . Extracellular matrix (ECM) and Cell membrane: membrane models with special reference to fluid mosaic model-Ultra-structure of chloroplast, mitochondria, ribosomes, Golgi bodies and vacuole. Microbodies: Lysosome, Peroxysome and Glyoxysome. Non-living cell inclusions: structure, location and function of starch grains , cystolith and raphides.

Unit II

Ultrastructure of Nucleus, nucleolus and nuclear pore complex; Structure of Polytene and B-chromosome, Nucleic acids: DNA composition, Watson and Crick model. RNA types and structures- t-RNA, r RNA ,m RNA

Unit III

Carbohydrates – Classification(Brief account) – structure of glucose, sucrose, starch and Cellulose.

Lipids- Classification (Brief account)– Differences between saturated and unsaturated fatty acids-structure of cholesterol. Pigments: Structure of Chlorophyll and Anthocyanin.

Unit IV

Amino Acids – Classification – properties – structure and function with special reference to Glycine, Alanine, Glutamic acid, Tryptophan and Methionine. Protein structure: Primary, Secondary, Tertiary and Quarternary structures – Classification and Properties of protein.

Unit V

Enzymes – Classification – Physico-chemical properties – Mechanism of enzyme action – enzyme activation and inhibition – coenzymes. Regulatory enzymes: Non covalently regulated enzymes (allosteric enzymes)-Covalently regulated enzymes. Fat-soluble and water-soluble vitamins- – Vitamins with coenzyme function.

Text Books:

1. Lea,P.J and Leegood, R.C. 2001. Plant Biochemistry and Molecular Biology, 2nd Ed. John Wiley and Sons Ltd. England.
2. Gupta ,M.L., and Jangir,M.L., 2001. Cell Biology. Updesh Purohit, Jodhpur.
3. Pawar,C.B., .1987. Cell Biology. Himalaya publishing House, Bombay.
4. Jain,J.L., 1999. Fundamentals of Biochemistry. S.Chand & Co. Ltd., New Delhi.

Reference books:

1. Lehninger,A.L. 1999. Biochemistry, 2nd Ed. Kalyani Publ., New Delhi.
2. De Robertis. 1980. Cell and Molecular Biology. Holt Saunders-Tokyo.

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| | | |
|---|---------------------|------------|
| Course: B.Sc., Botany | Code No | : EMB51(H) |
| Semester: 5 | No. of Hrs allotted | : 75 |
| Paper: Elective-3 | No. of Credits | : 3 |
| Title of the Paper: HORTICULTURE | Marks: 25 + 75 = | 100 |

Objectives:

1. To learn the basics of gardening.
2. To learn the applied aspects of Horticulture.
3. To learn to occupy oneself during leisure time.
4. To use the space one has for productive purposes.
5. To appreciate the beauty of flowers.
6. To learn the basics and develop the skill in flower arrangement.
7. To acquire knowledge in the preparation of Horticultural products.

Unit : I

Scope and importance of Horticulture, Basics of gardening:- Garden implements. Preparation of pots, Transplanting, Pruning and Training, Irrigation methods, Manuring and Weeding.

Unit II

Propagation techniques:- Seed propagation (Direct sowing, Broadcasting). Separation of Division, Cuttage: leaf, stem and root cuttings- Layerage: Ground and Air layering –Graftage: Detached scion, Approach and 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 Gardening: Choice of plants and maintenance, Bottle garden, Hanging pots,- Bonsai: Techniques and Maintenance, Choice of plants.

Unit IV

Classification of horticultural plants. Planning and lay out of Orchards, Cultivation methods for 1) Fruit crops: Mango, Banana 2)Vegetable crops:Brinjal,Onion. Kitchen garden: Importance, lay out and choice of plants.

Unit V

Applied Horticulture: Flower arrangements: Different designs. Do's and Don'ts in flower arrangements. Dry flower decorations. Composting, Vermicomposting. Processing and use of horticultural products-Jam,Jelly, Squash, Tomato Ketchup and Pickles.

Text Books:

1. Rao,K.M. 1991. Textbook of Horticulture, MacMillan India Ltd., New Delhi
2. Vishnu Swarup. 1997. Ornamental Horticulture, MacMillan India Ltd, New Delhi.
3. Chandha,K.L.2001.Handbook of Horticulture. ICAR Publications, New Delhi.

Reference Books:

1. Adarance,Wand Brison, F.R. 1979. Propagation of Horticultural Plants, Tata McGraw-Hill Publishing company, Ltd., New Delhi.
2. Acquaah,G. 1999. Horticulture. Principles and practices, Prentice Hall, New Jersey.
3. Adams, C. R. and Early, M.P. 2005. Principles of horticulture. Rajkamal Press. Delhi.
4. Prasad and Kumar, U. 2005. Commercial floriculture. Agrobios (India). Jodhpur.

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| | | |
|-------------------------------------|----------------------|--------------|
| Course: B.Sc., Botany | Code No | : ENB51(F) |
| Semester: 5 | No. of Hrs allotted: | 30 |
| Paper: Skill based Elective-6 | No. of Credits | : 2 |
| Title of the Paper: FORESTRY | Marks: | 15 + 35 = 50 |

Objectives:

1. to understand the composition and diversity of forest ecosystem
2. to know the method of forest protection and management

Unit-1

Composition of forest types in India - Major forest types and distribution with special reference to Tamilnadu. Role of climate in the distribution of forests. Forests as centre of Biodiversity.

Unit -II

Forests conservation and protection. *in situ* conservation and *ex situ* conservation. Protection – National Forest Policy, 1953, Forest conservation Act, 1988. Role of national Sanctuaries, national parks and Biosphere Reserve in Forest conservation. Botanical Gardens and conservation of forest plants. Role of peoples (chipko) movement in forest conservation.

Text Books:

1. Srivastava, P.B. 2001. An introduction to Forestry. National Book Trust. New Delhi
2. Agarwal, P. 1985. Forests in India. Oxford & IBH Publishing Co. Ltd. New Delhi.

Reference Books:

1. Jamaes, P. Kimmins. 2004. Forest Ecology. Prentice Hall, Inc. USA
2. William F. Laurance and Richard O. Bieringaarde. 1997. Tropical Forest Remnants: Ecology, Management and conservation of fragmented communities. University of Chicago Press. USA
3. Sagreiya, K.P. 1979. Forest and Forestry. National Book Trust. New Delhi.

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| | | |
|---|---------------------|--------------|
| Course: B.Sc., Botany | Code No | : ENB51(S) |
| Semester: 5 | No. of Hrs allotted | : 30 |
| Paper: Skill based Elective-6 | No. of Credits | : 2 |
| Title of the Paper: SILVICULTURE | Marks: | 15 + 35 = 50 |

Objectives:

1. To understand the management natural and plantation forest ecosystem
2. To know the method of cultivation, Collection and manufacture of minor forest products.

Unit-I

Introduction and Scope – Forest plantation – Forest Industries and Products – Silviculture applications – Social Forests – Farm forests – Plantation Forests – Agro forests.

Unit-II,

Silviculture management – Trees selection, Plantation site and soil – preparation, management – Plantation management – Biofertilizers utilization in Silviculture.

Text Books:

1. Ralph D. Nyland 2007. Silviculture; Concepts and Applications. Waveland Press.
2. Mark . S. Ashton, Florencia Montagnini. 2000. The Silvicultural basis for Agroforestry systems. CRC Press

Reference Books:

1. Nair, P.K. R. 1993. An Introduction to Agroforestry. Springer Publishers
2. Bhanwar lal Sharma, R. Vishnoi, 2000. Perspective on Social Forestry.

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Course: B.Sc., Botany

Code No :

Semester: V

No. of Hrs allotted:

Paper: Self study

No. of Credits:

Title of the Paper: **BOTANICAL WORLD**

Marks: 15 + 35 = 50

Objective :

- To acquire the basic knowledge of plants.
- To understand the role of plants in day-to-day life.

UNIT I :

Wonder Plants :Tree fern, Tallest tree (*Sequoia*), century plant (*Agave*), Bamboo, biggest flower (*Rafflesia arnoldii*),

Largest leaf (*Victoria regia*), Neelakurinji flower (*Strobilanthes kunthianus*) , Sensitive plant (*Mimosa pudica*), Orchids, Insectivorous plants.

Plant Animal interaction : Symbiosis, Myrmecophily, lac insect, Pollination mechanism and honey.

UNIT II :

Plants of the Past : Fossil fuels. Plants as : Food makers (primary producers), Scavengers (decompositions),

Purifiers (air, water), Industrialists (antibiotics, vaccines, vitamins, beverages, biofertilizers).

Medicine (Tulsi,

Pepper, Ginger, Eucalyptus, Kilanelli and Turmeric)

Text Books:

1. G. Brum, L. Mc Kane and G. Karp. 1995. Biology Fundamentals, John Wiley & Sons, Inc., Canada.,
2. D. K. Northington, 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, John Murray.,
2. 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

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|--|---------------------|-----------------|
| Course: B.Sc., Botany | Code No | : MBL51 |
| Semester: 5 | No. of Hrs allotted | : 120 |
| Paper: Core Practical -3 | No. of Credits | : 4 |
| Title of the Paper: -(for MB51 & MB52) | Marks | : 40 + 60 = 100 |

GENETICS, EVOLUTION AND BIOSTATISTICS-Lab Course - Contact Hours per week: 4

Problem solving in Genetics:

1. Monohybrid cross and Test cross.
2. Dihybrid cross and incomplete dominance.
3. Interaction of genes: 9:7 and 9:3:4.
4. Interaction of genes: 12:3:1 and 15:1.

Problem solving in Biostatistics:

5. Mean, Median and Mode calculation.
6. Calculation of range and standard deviation.
7. Chi-square test.
8. Drawing graphs, diagrams for the given data.

CELL BIOLOGY AND BIOCHEMISTRY-Lab Course - Contact Hours per week: 4

1. Estimation of DNA content from Cauliflower
2. Estimation of RNA content.
3. Qualitative tests for amino acids, Carbohydrate and Proteins.
4. Quantitative estimation of amino acids .
5. Quantitative estimation of soluble sugars, soluble and insoluble starch.
6. Quantitative estimation of protein
7. Quantitative estimation of soluble starch
8. Separation of amino acids and sugars by paper chromatography.
9. Enzyme activity –Amylase
10. Estimation of Cholesterol
11. Estimation of palmitic acid content
12. Absorption spectrum of anthocyanin.
13. Cell division: Mitosis – Onion root tip
14. Study of cell inclusions – starch grains from banana, rice & potato
15. Study of cell inclusions-Cystolith (*Ficus* leaf), raphides (*Pothos* leaf)

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| | | |
|---|---------------------|--------|
| Course: B.Sc., Botany | Code No | : MB61 |
| Semester: 6 | No. of Hrs allotted | : 180 |
| Paper: Core -9 | No. of Credits | : 5 |
| Title of the Paper: PLANT PHYSIOLOGY | Marks: 25 + 75 = | 100 |

Objectives:

1. To acquire the basic knowledge needed for proper understanding of plant functioning.
2. To make the students realize the importance of all physiological processes that takes place in plants.

Unit I

Water relations in Plants: Permeability-Flick's law, Diffusion and Osmosis-DPD and imbibitions. Absorption of water, ascent of sap. Transpiration: Types and Mechanism of Stomatal movement.- antitranspirants -- Starch – sugar hypothesis, active K⁺ transport . Guttation (in brief).

Unit II

Mineral nutrition : Role of minerals in plants, major and trace elements, essentiality criteria of an element, classification of elements. Deficiency symptoms of nutrients. Active and passive absorption of minerals.

Unit III

Photosynthesis: Concept of photosynthesis, photosynthetic units, quantum yield, Red drop effect and Emerson enhancement effect . Hill reaction. Light trapping by chlorophyll molecules. Energy transfer to reaction centers. Z-scheme of photosynthesis, – Cyclic and non-cyclic photo phosphorylation. Calvin & Benson cycle, . Factors affecting photosynthesis – Photorespiration (in brief).

Unit IV

Respiration: Aerobic respiration –Glycolysis – TCA cycle– Oxidative Phosphorylation . Factors affecting respiration. Nitrogen metabolism: Sources of nitrogen. . Biological nitrogen fixation: asymbiotic and symbiotic. – assimilation.

Unit V

Growth regulators – auxins, gibberellins, cytokinins , abscissic acid and ethylene, their physiological role. Physiology of flowering: Photoperiodism – Vernalization. . Seed dormancy and bud dormancy, methods of breaking dormancy, mechanism of seed germination. Chemical changes and hormonal regulation during fruit ripening, artificial fruit ripening.

Text Books:

1. Pandey, S.N and Sinha, B.K. 1989. Plant Physiology, Vikas Pub. House . New Delhi.
2. Noggle,G.R.and Fritz, G.J. Introductory Plant Physiology, 2nd Ed. Prentice-Hall of India Ltd., New Delhi.
3. Jain, V.K. 1988. Fundamentals of Plant Physiology, S.Chand and Co. Ltd.,New Delhi.
4. Gupta, N.K and Gupta,S.2005. Plant Physiology. Oxford &IBH publishing co. .Ltd.New Delhi
5. Sundararajan, S. 2000.Plant Physiology. Anmol Publication Ltd. New Delhi.
6. Mukherji. S. and Ghosh, A.K. 2005. Plant physiology. New Central Book Agency Ltd. Kolkata

Reference Books:

1. Salisbury, F.B. and Ross, C.W. 1992. Plant Physiology. Asia Ltd. Singapore.
2. Devlin, R.M. and Witham, F.H. 1986. Plant Physiology, 4th Ed. CBS Pub. Delhi..

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DEPARTMENT OF BOTANY
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Course: B.Sc., Botany

Semester: 6

Paper: Core -10

Title of the Paper: **BIOTECHNOLOGY**

Code No : MB62

No. of Hrs allotted: 150

No. of Credits : 5

Marks: 25 + 75 = 100

Objectives:

1. To enlighten the students on the basic principles of the biotechnological innovations.
2. To know about the various microbes used as Biofertilizers.
3. To learn the various methods of mass cultivation.
4. To understand the concepts and principles of fermentation technology.
5. To relate and apply various aspects of fermentation for betterment of human life.

Unit I

Genetic Engineering: Tools - Restriction endonucleases, DNA ligases, Reverse transcriptase, Alkaline phosphatase; Cloning vectors: Plasmids, Bacteriophages. cDNA clones - Gene bank - Genomic library. Techniques: Insertion of DNA fragment into vector - Transfer of recombinant DNA into bacterial cells.

Unit II

Solid state fermentation (SSF) – Submerged State Fermentation (SmSF) – Batch, Continuous, Fed batch fermentation. Alcoholic fermentation: Beer production and Industrial alcohol production.

Unit III

Industrial production of Penicillin and Citric acid. Cultivation and processing of Single Cell Protein: *Chlorella* and Yeast – Out-door Mariculture technique: Agar production from *Gracilaria*.

Unit IV

Biomining , Bioleaching of copper , uranium and gold. Recovering of minerals from microorganisms, recovering of oil and single cell oil.

Unit V

Culture of plant tissues, Regeneration of plants, Root culture, meristem culture, Anther culture, Pollen culture. Role of tissue culture technology in crop improvements. Artificial seeds – transgenic plants, selectable markers and their use in transformed plants – cat gene – lux gene.

Text Books:

1. Kumar, H.D. 2001. A Textbook on Biotechnology. 2nd Ed. East-West Press. New Delhi.
2. Subba Rao, N.S. 2001. Soil Microbiology, 4th Ed. Oxford and IBH Publishing Co. New Delhi.
3. Dubey, R.C. 2002. A text book of Biotechnology, S. Chand and Co. New Delhi.
4. Singh, B.D. 1998. Biotechnology. Kalyani Pubs. New Delhi.
5. Patel, A.H., 1996. Industrial Microbiology. Mac Millan India Ltd. Delhi.
6. Kumaresan, V. 1994. Biotechnology. Saras Pubs., Nagercoil.

Reference Books:

1. Ignacimuthu, S.J. 1997. Plant Biotechnology, Oxford and IBH Publishing Co., New Delhi.
2. Yeoman, J.R.M.M. 1982. Cell and Tissue culture . Narosa Publishing House, New Delhi.
3. Reinert, J. and Bajaj, Y.P.S. 1997. Plant cell, tissue and organ culture. Narosa Publishing House, New Delhi.

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| | | |
|--|----------------------|--------------|
| Course: B.Sc., Botany | Code No | : ESB61(E) |
| Semester: 6 | No. of Hrs allotted: | 30 |
| Paper: Skill based Elective-6 | No. of Credits | : 2 |
| Title of the Paper: ENVIRONMENTAL BIOTECHNOLOGY | Marks: | 15 + 35 = 50 |

Objectives:

1. To enable the students to know about environmental biotechnology.
2. To impart knowledge on waste disposal and bioleaching.

Unit 1

Composition of sewage – Biological treatment of sewage – sludge treatment and disposal – Composting – Vermicomposting – Biodegradable plastics and Eco-friendly products.

Unit 2

Microbial mining – Organisms for leaching – Recovery of Copper – Bio energy from waste: Biogas, Fuel alcohol and Hydrogen production with bacteria, blue-green algae and seaweeds.

Text Books:

1. Jugdarad, S. N. 2004. Environmental Biotechnology, Himalaya publishing House, Mumbai.
2. Markandy, D.K. and Rajvaidys, N. 2004. Environmental Biotechnology, APH Publishing Corporation, New Delhi.

Reference Books:

1. Dubey,R.C. 2002. A text book of Biotechnology, S. Chand and Co. New Delhi.
2. Singh,B.D. 1998. Biotechnology. Kalyani Pubs. New Delhi.

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Course: B.Sc., Botany

Code No : ESB61(M)

Semester: 6

No. of Hrs allotted: 30

Paper: Skill based Elective-6

No. of Credits : 2

Title of the Paper: **MARINE BIOTECHNOLOGY**

Marks: 15 + 35 = 50

Objectives:

- To study marine zonations, Phytoplankton, Aquaculture, utilization and marine pollution

Unit-1

Different strata of Oceanic habitat. Zonations- Seaweeds and Sea grasses. Water bloom-Toxic Dinoflagellates -Bioluminescence. Phytoplankton, Primary productivity, Marine food web .

Unit-II

Sea weed cultivation-Field aquaculture-Pearl culture, Prawn culture. Industrial uses of Agar, Alginates and Carrageenan. Marine Pollution: Pollution due to heavy metals, radioactive wastes, thermal and oils.

Text Books:

1. Arnon, 1978, 1988, and 1993. A report on the seaweeds resources of Tamil Nadu. Central salt and marine fisheries research institute. Cochin.
2. Balakrishanan Nair, N and D.M. Thampy.1980. A text book of marine ecology. The Mac Millan Co., of India Ltd. pp.352.

Reference Books:

1. Sundaralingam, V. 1991. Marine Algae, Bishan Singh and Mahendra Pal Singh Publishers, Dehradun.
2. Venkataraman, G.S. 1974. Algae: Form and Function. To-days & Tomorrow's publishers, New Delhi.
3. Waldichunk. M. 1977. Global Marine Pollution: an Overview. UNESCO. Paris.

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DEPARTMENT OF BOTANY
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Course: B.Sc., Botany

Code No : MBL61

Semester: 6

No. of Hrs allotted: 150

Paper: Core Practical -4

No. of Credits : 4

Title of the Paper: –(for MB61 & MB62)

Marks: 40 + 60 = 100

PLANT PHYSIOLOGY – LAB Course - Contact Hours per week: 6

1. Demonstration of osmosis by potato Osmoscope.
2. Determination of water potential by gravimetric method.
3. Determination of water potential by falling drop method.
4. Effect of light intensity on photosynthesis
5. Effect of monochromatic light on photosynthesis
6. Effect of HCO₃ on photosynthesis.
7. Determination of stomatal index.
8. Determination of growth curve by leaf area method.
9. Determination of imbibition by gravimetric method.
10. Differentiation of C₃ and C₄ plants by starch test.
11. Differential transpiration of leaf surfaces.
12. Demonstration of fermentation using Kuhn's flask
13. Demonstration of Ganong's light screen experiment
14. Demonstration of growth measurement using Arc auxanometer
15. Demonstration of Klinostat experiment
16. Demonstration of Thistle Funnel experiment
17. Demonstration of transpiration using Ganong's potometer
18. Demonstration of transpiration using Bell jar experiment

BIOTECHNOLOGY-Lab Course -Contact Hours per week: 4

1. Callus initiation from tobacco leaf explant
2. Callus initiation from carrot root explant
3. Isolation of protoplasts from leaves
4. Alcohol fermentation by yeast.
5. Yeast biomass estimation by turbidity method.
6. Demonstration of protoplast isolation from fungi
7. Demonstration of protoplast fusion using PEG
8. Isolation of *Rhizobium* from root nodules.
9. Effect of biofertilizers on plant growth.
10. Isolation of genomic DNA from Onion.
11. Isolation of antibiotic resistant mutants by gradient plate technique.
12. Isolation of auxotrophic mutants by replica plating technique.

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DEPARTMENT OF BOTANY
BSc Ancillary Botany Syllabus
COURSE STRUCTURE (w.e.f 2011-12 batch onwards)

SEMESTER –III & IV

| Code No. | Subject | Contact Hrs/ Week | Credits | Total No. Of Hrs Allotted | Max Marks CA | Max Marks SE | Total |
|----------|---|-------------------|---------|---------------------------|--------------|--------------|-------|
| AI 31(B) | Angiosperm Taxonomy and Medicinal plants | 4+2 | 4 | 90 | 25 | 75 | 100 |
| AI41(B) | Basics of Biotechnology | 4+2 | 4 | 90 | 25 | 75 | 100 |
| AIL 41 | Allied practical paper (for AI 31(B) and AI41(B)) | | 2 | | 40 | 60 | 100 |

Scheme of Examination:

Theory examination (for the above two papers) will be conducted at the end of each semester.

Internal – 25 Marks (Test 20 marks (duration 2 Hours) + Assignment 5 marks)

External – 75 Marks (Duration 3 Hours)

Practical Examination will be conducted at the end of the academic year.

Internal 40 (Record 10 marks + Test/continuous assessment – 30 marks)

Record – Odd Sem. 5 and Even Sem. 5- Total 10 marks.

Continuous assessment (for both sem.) = 15 + 15 = 30 marks

External – 60 marks (Duration 3 Hours)

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DEPARTMENT OF BOTANY
(from 2011-12 batch onwards)

Course: Ancillary Botany for IMB

Code No : AI31(B)

Semester: 3

No. of Hrs allotted: 90

No. of Credits : 4

Title of the Paper: **ANGIOSPERM TAXONOMY AND MEDICINAL PLANTS**

Marks: 25 + 75 = 100

Course Objective:

- To know the local flora and to classify them systematically
- To know the principles of Systematics
- To realize the significance of medicinal plants
- To understand the medicinal importance of plants

Unit – I:

Binomial nomenclature – Bentham and Hooker's classification. Study the salient features of the following families:

1. *Annonaceae* 2. *Capparidaceae* 3. *Meliaceae* 4. *Rubiaceae* 5. *Asteraceae* 6. *Sapotaceae*
7. *Solanaceae* 8. *Lamiaceae*

Unit – II:

Study the salient features of the following families:

9. *Amaranthaceae* 10. *Euphorbiaceae* 11. *Amaryllidaceae* 12. *Commelinaceae* 13. *Poaceae*

Unit – III:

Classification of drugs obtained from plants – Morphological and chemical. General account on collection, harvesting, drying, garbling and packing

Unit – IV:

Botanical Name, family, common names, morphology of useful parts, chemical constituents and the medicinal uses of the following plants:

1. *Adathoda* and *Ocimum*
2. *Azadirachta* and *Curcuma*
3. *Dodonaea* and *Cardiospermum*
4. Indian *Acalypha* and *Hedychium*
5. *Gymnema* and *Aegle*
6. *Nelumbo* and *Holarrhena*
7. *Catharanthes* and *Taxus*

Unit – V:

Botanical Name, family, other common names, morphology of useful parts, chemical constituents and the medicinal uses – crude drug preparation procedures of the following plants:

1. *Cassia senna* and *Terminalia chebula*
2. *Syzygium aromaticum* and *Zingiber officinale*
3. *Andrographis paniculata* and *Phyllanthus niruri*
4. *Aloe vera* and *Tinospora cordifolia*
5. *Centella asiatica* and *Evolvulus alsinoides*
6. *Digitalis purpurea* and *Terminalia arjuna*
7. *Tribulus terrestris* and *Dolichos biflorus*

Text Books:

1. Tod F. Stuessy (2009), Plant taxonomy: The systematic evaluation of comparative data – Columbia University Press, USA.
2. T. Pullaiah (2007) Taxonomy of Angiosperms –, Regency Publishers, Regency Publications, New Delhi.
3. Bharati Battacharyya (2005), Systematic Botany –Alpha Science International, Florida, USA.
4. C.K. Kokate, Purohit, A.P., Gokhale, C.B. (2003), Text Book of Pharmacognosy –Nirali Prakshan, Pune.
5. N.C. Kumar, (1993) An Introduction to medical botany and Pharmacognosy – , Emkay Publications, New Delhi.
6. A.V.S.S. Sambamoorthy (2005) Taxonomy of Angiosperms –I. K. International Pvt Ltd, New Delhi
7. O.P. Sharma (1993). Plant Taxonomy – Tata Mc Graw-Hill, New Delhi

Reference Books:

1. Armen Takhtajan, 2009. Flowering Plants, Springer Publications, UK
2. Rodolphe Spichiger, Mathieu Perret (2004), Systematic Botany of Flowering Plants: A new phylogenetic approach to angiosperms of the temperate and tropical regions Science Publishers, British Isles, USA
3. Trease and Evans (2004), Pharmacognosy - Elsevier, China
4. Mohammed Ali (1998), Text Book of Pharmacognosy –CES Publishers and Distributors, New Delhi.
5. Clive Anthony Stace (1991), Plant Taxonomy and Biosystematics –Cambridge University Press, UK.

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Course: Ancillary Botany for IMB
Semester: 4

Code No : AI41(B)
No. of Hrs allotted: 90
No. of Credits : 4

Title of the Paper: **BASICS OF BIOTECHNOLOGY**

Marks: 25 + 75 = 100

Objectives:

- To enlighten the students on the basic principles of the biotechnological innovations.
- To familiarize the students with the basic principles and techniques in tissue culture.
- To know about the various microbes used as Biofertilizers.

Unit I Introduction- Definition – Biotechnology as interdisciplinary field of science – scope, potentials and limitations. Genetic Engineering: tools and techniques for insertion of foreign DNA into vectors, transfer of recombinant DNA into host cells – selection of clones - cloning with reference to insulin gene.

Unit II Plant tissue culture: Explant culture - callus formation, organogenesis and transgenic plants – Cloning of glyphosate gene. protoplast culture: Protoplast fusion and somatic hybridization. Applications of plant tissue culture.

Unit III Biological nitrogen fixation: Mechanism of nitrogen fixation in symbiotic legumes – bacterial system and nitrogenase complex – hydrogenase. Biofertilizers: Mass cultivation of *Rhizobia*, *Cyanobacteria* and *Mycorrhizae*.

Unit IV Enzyme technology: Methods of enzyme production, purification of enzymes, fluid filtration and immobilization of enzymes. Biomass as energy source - energy plantations, petrocrops. Biofuels: Methanogenesis and biogas production, hydrogen production. Production of alcohol from molasses.

Unit V Production of single cell protein: Yeast and *Spirulina*. Waste treatment and utilization: Mushroom production on agrowastes, Vermicomposting, Treatment and recycling of sewage and industrial effluents – primary, secondary and tertiary treatment. Biopesticides. Biodegradable plastics.

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.

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. Nirmala,C.B., G. Rajalakshmi, Chandra Karthick. 2009. Plant Biotechnology. MJP publishers,Chennai
4. Chawla,H.S. 2008. Introduction to plant Biotechnology. Oxford & IBH publishing co., Pvt. Ltd. New Delhi.

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| | |
|---|--------------------------|
| Course: Ancillary Practical for IMB | Code No : ABL41(C) |
| Semester: 4 | No. of Hrs allotted : 60 |
| Paper: Lab | No. of Credits : 2 |
| Title of the Paper: -(for AI 31(B) & AI41(B)) | Marks: 40 + 60 = 100 |

Angiosperm Taxonomy and Medicinal Plants – Lab
Contact Hours per week: 2

1. Anatomical Study of Ginger Rhizome
2. Microscopic study of *Adathoda* leaf
3. Preparation of leaf extract from Neem and tulsi leaves
4. Preparation of syrup from rhizome and ginger
5. Preparation of paste from turmeric
6. Vegetative and floral characters study of the following families:
 1. Annonaceae
 2. Capparidaceae
 3. Meliaceae
 4. Rubiaceae
 5. Asteraceae
 6. Sapotaceae
 7. Solanaceae
 8. Lamiaceae
 9. Amaranthaceae
 10. Euphorbiaceae
 11. Amaryllidaceae
 12. Commelinaceae
 13. Poaceae

BASICS OF BIOTECHNOLOGY -LAB

- Contact Hours per week: 2.

1. Callus induction from carrot root explant..
2. Isolation of *Rhizobia* from root nodules.
3. Plate assay for extra-cellular enzyme production by microorganisms.
4. Production of ethanol by yeast.
5. Biodegradation of wastes using microbes.
6. Effect of treated effluent on seed germination.
7. Mushroom production from agrowastes.
8. Vermicomposting.
9. Protoplast fusion using PEG.
10. Effect of biofertilizers on plant growth.
11. Seed pelleting with biofertilizers.

THIAGARAJAR COLLEGE (AUTONOMOUS) MAUDURAI-9
DEPARTMENT OF BOTANY
MASTER OF SCIENCE IN BOTANY
COURSE STRUCTURE (w.e.f 2011-12 batch onwards)

SEMESTER -I

| Code No. | Subject | Contact Hrs/Week | Credits | Total No. of Hrs Allotted | Max. Marks. CA | Max. Marks. SE | Total |
|---------------------|---|------------------|---------|---------------------------|----------------|----------------|-------|
| I Semester | | | | | | | |
| 1PB1 | Thallophytes, Bryophytes, Pteridophytes and Gymnosperms | 7 | 5 | 105 | 25 | 75 | 100 |
| 1PB2 | Microbiology and Plant Pathology | 6 | 5 | 90 | 25 | 75 | 100 |
| 1PBE(E) | Elective-1 Embryology of Angiosperm | 5 | 5 | 75 | 25 | 75 | 100 |
| 1PBL1 | Practical – I | 6 | 4 | 90 | 40 | 60 | 100 |
| 1PBL2 | Practical – II | 6 | 4 | 90 | 40 | 60 | 100 |
| | Total | 30 | 23 | 450 | 155 | 345 | 500 |
| II Semester | | | | | | | |
| 2PB1 | Biological Chemistry and Biotechniques | 7 | 5 | 105 | 25 | 75 | 100 |
| 2PB2 | Plant Physiology | 6 | 5 | 90 | 25 | 75 | 100 |
| 2PBE(B) | Elective-2 Basics of Computer, Bioinformatics and Biostatistics | 5 | 5 | 75 | 25 | 75 | 100 |
| 2PBL1 | Practical – I | 6 | 4 | 90 | 40 | 60 | 100 |
| 2PBL2 | Practical – II | 6 | 4 | 90 | 40 | 60 | 100 |
| | Total | 30 | 23 | 450 | 155 | 345 | 500 |
| III Semester | | | | | | | |
| 3PB1 | Angiosperm Taxonomy | 6 | 5 | 90 | 25 | 75 | 100 |
| 3PB2 | Biodiversity and conservation | 6 | 5 | 90 | 25 | 75 | 100 |
| 3PBE(F) | Elective for non major students: Forestry | 2 | 2 | 30 | 15 | 35 | 50 |
| 3PBL1 | Practical – I | 8 | 5 | 120 | 40 | 60 | 100 |
| 3PBL2 | Practical – II | 8 | 5 | 120 | 40 | 60 | 100 |
| | Total | 30 | 22 | 450 | 145 | 305 | 450 |
| IV Semester | | | | | | | |
| 4PB1 | Molecular Genetics | 7 | 5 | 105 | 25 | 75 | 100 |
| 4PB2 | Biotechnology | 7 | 4 | 105 | 25 | 75 | 100 |
| /PJ | Elective-3 Project | 5 | 5 | 75 | 40 | 40+20 | 100 |
| 4PBL1 | Practical – I | 5 | 4 | 75 | 40 | 60 | 100 |
| 4PBL2 | Practical – II | 6 | 4 | 90 | 40 | 60 | 100 |
| | Total | 30 | 22 | 450 | 170 | 330 | 500 |

Theory: Internal: 25 Marks [Assignment 5 marks; Seminar 15 marks; Test 30 marks (duration 2 hrs). 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/open) 20 = 100.

A) Consolidation of Contact Hours and Credits: PG Botany

| Semester | Contact Hrs / Week | Credits |
|----------|--------------------|---------|
| I | 30 | 23 |
| II | 30 | 23 |
| III | 30 | 22 |
| IV | 30 | 22 |
| Total | 120 | 90 |

B) Curriculum Credits

Core73 -Credits
Major Elective15 -Credits
NME.....02 - Credits

Total
90 Credits

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Course: M.Sc., Botany

Code No : 1PB1

Semester: 1

No. of Hrs allotted: 105

Paper: Core

No. of Credits : 5

Title of the Paper: **THALLOPHYTES, BRYOPHYTES, PTERIDOPHYTES & GYMNOSEPERMS**

Marks: 25 + 75 = 100

Course Objectives:

- To learn the diversity, structural organization and reproduction of lower plants- Algae, Fungi, Lichens and Bryophytes.
- To introduce the students the economic value of Thallophytes, Bryophytes and their exploitation by humans
- To learn the diversity, structural organization and reproduction of Pteridophytes and Gymnosperms.

Unit -I

Classification of algae by Chapman – General characters of the following divisions: Cyanophyta, Chlorophyta, Phaeophyta and Rhodophyta – Range of thallus construction in Chlorophyceae – Life cycle patterns in Phaeophyceae . Economic importance of Algae

Unit -II

Classification of fungi by Ainsworth - General characters of the following classes : Myxomycetes, Ascomycetes, Basidiomycetes and Deuteromycetes. Economic importance of fungi. Lichens: nature and composition – habit and habitat – classification – Vegetative and Sexual reproduction. Economic importance.

Unit -III

Classification of bryophytes by Watson. Characteristic features of *Hepaticopsida*, *Anthocertopsida* and *Bryopsida*. Range of gametophytes and sporophytes in Bryophytes. Economic importance of Bryophytes.

Unit -IV

Classification of Pteridophytes by Reimer. 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. 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. Alexopoulos, J. and Mims, M. 1993. Introductory Mycology. Wiley eastern Ltd., New Delhi.
3. Gupta, J.S. 1986. Textbook of fungi. Oxford and IBH publishing Company Pvt. Ltd., New Delhi
4. Vashista, B.R. 1988. Bryophyta. S. Chand and Company Ltd., New Delhi.
5. Rashid, A. 1998. An introduction to bryophytes. Vikas Publishing House Pvt. Ltd., New Delhi.
6. Ahamadjian, V. 1973. The Lichens. Academic Press. New Delhi.
7. Rashids, A. 1998. An introduction to Pteridophyta. Vikas publishing House Pvt. Ltd., New Delhi.
8. Sharma, O.P. 1990. Textbook of Pteridophyta. MacMillan India Ltd., New Delhi.
9. Vashista. P.C. 1989. Gymnosperms. Vol. V., S. Chand and Company Ltd., New Delhi
10. Sporne, K.R. 1965. The morphology of Gymnosperms. B. I. Publications, New Delhi.

Books for Reference :

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.

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Course: M.Sc., Botany

Code No : 1PB2

Semester: 1

No. of Hrs allotted: 90

Paper: Core

No. of Credits : 5

Title of the Paper: **MICROBIOLOGY AND PLANT PATHOLOGY**

Marks: 25 + 75 = 100

Course Objectives:

1. To understand the classification, nutrition, and growth of microorganisms
2. To acquire knowledge about soil, water and food microorganisms
3. To understand the development of a disease, host-pathogen interaction, and the reasons for an epidemic disease.
4. To imbibe the knowledge of different control methods of plant diseases and etiology of selective plant diseases.

Unit –I : General account of microbes:- Whitaker's five kingdom concept – Prokaryotic and eukaryotic microbes – Bacteria: classification (Bergey's manual of systematic Bacteriology) – general account of Archaeobacteria, Eubacteria and Cyanobacteria. Viruses: general structure – classification – transmission – multiplication (bacteriophage) – Viroids and Prions – Phytoplasma (including Mycoplasma).

Unit –II: Microbial nutrition: Nutritional Groups-Cytoplasmic membrane architecture in Bacteria – Transport of nutrients across membrane. Culture media – types. Microbial growth-growth curve-measurement of microbial growth by cell numbers and cell mass-Continuous growth: Chemostat, Turbidostat. Environmental factors affecting growth-Microbial growth in natural environments-Liebig's law of minimum-Shelford's law of tolerance-

Unit- III : Soil Microbiology: Microbial interactions-Mutualism, Commensalism, Parasitism and Symbiosis. Microbial associations: Neutral, positive, negative. Nutrient cycling interactions – Carbon cycle, Nitrogen cycle, Sulfur cycle, Iron cycle, Microbes and metal toxicity – Biofilms. Aquatic Microbiology: Microbes in fresh water and marine environment – Waterborne pathogens and water purification-quality analysis of potable water. Biological waste water treatment. Microbiology of fermented foods: food spoilage and preservation.

Unit- IV: General principles and concepts in plant pathology – classification of plant diseases based on symptoms. Infection process:- Entry of pathogen – establishment of pathogen (enzymes and toxins). Defense mechanism: Structural & Biochemical. Epidemiology: Forms of epidemics, Conditions governing epidemics, Reasons for progressive severity of epidemics & decline of epidemics – disease forecasting.

Unit –V:: 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) ALGAE: Red rust of tea , b) FUNGI: Blast disease of paddy, Wheat rust, c) BACTERIA: Cotton blight, Citrus canker, d) VIRUS: Bendi yellow vein clearing virus, Cucumber mosaic virus. e) PHYTOPLASMA: Brinjal little leaf, *Sesamum* phyllody

Text Books:

1. Prescott, L.M., Harley, J.P. and Klein, D.A. 1996. Microbiology. Wm.C.Brown Publishers, London.
2. Pommerville, J. C. 2006. Alcoma's Fundamentals of Microbiology. Jones and Bertlett Publishers, London.
3. Atlas, R.M. 1995. Principles of Microbiology. Morby Publishers, St.Louis.
4. Pelezar, M., Chan, E.C.S. Krieg, N.R. 1993. Microbiology – Concepts and Applications. McGraw Hill Ltd., Inc., N.Y
5. Stanier, R.Y., Ingrahm, J.L., Wheelis, M.L. and Painter, P.R. 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. 2000. Plant pathology. Elsevier, New Delhi.

Books for Reference :

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

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Course: M.Sc., Botany

Code No : 1PBE(E)

Semester: 1

No. of Hrs allotted: 75

Paper: Elective -1

No. of Credits : 5

Title of the Paper: **EMBRYOLOGY OF ANGIOSPERM**

Marks: 25 + 75 = 100

Course Objectives:

- To understand the various developmental stages of plant embryo.
- To understand the structure of plant tumours and plant galls.
- To know about morphogenesis.

Unit -I

Anther: Structure and development. Anther wall & Tapetum: Origin, cytology and function. Pollen: Ultra structure of wall, storage and germination. Pollen-pistil interaction Ovule: Structure and development. Female gametophyte: Ontogeny of embryo sac, nutrition and morphology of embryo sac.

Unit- II

Fertilization: Ultra structural studies on fertilization- sexual incompatibility- Endosperm: Types, Haustorial organization and cytology-Xenia and Metaxenia- Ruminant endosperm.

Unit- III

Embryo: Proembryo, primitive embryo, one example of advanced embryo in dicot and monocot, views on monocot embryo, grass embryo - agamospermy and polyembryony.

Unit -IV

Culture methods: Prospects and significance of anther, ovary, ovule, nucellus, embryo and endosperm culture - Isolation and culture of protoplast- Fruit :Biochemical,Physical factors in fruit development-structure of pericarp and parthenocarpy.

Unit -V

Role of IAA in differentiation-factors influencing morphogenesis: polarity, - Plant Galls: Classification, types- Plant tumours: General features.

Text books:

1. Mani, M.S. 1973. Plant galls of India. MacMillan India Ltd., Madras.
2. Burgess, J. 1985. An Introduction to plant cell development. Cambridge University Press, Cambridge.
3. Bhojwani, S.S and Bhatnagar, S.P.1992. The Embryology of Angiosperms. Vikas Publishing Housing Pvt.Ltd., New Delhi.
4. Maheswari P. 1985. An Introduction to the Embryology of Angiosperm. Tata McGraw-Hill Publishing Company, New Delhi.
5. Varghess, T.M.1984. An introduction to experimental and applied embryology of angiosperms. Oxford and IBH publishing Company, 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. Tata McGraw Hill Publishing Company, New Delhi.

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| | | |
|---|----------------------|---------|
| Course: M.Sc., Botany | Code No | : 1PBL1 |
| Semester: 1 | No. of Hrs allotted: | 90 |
| Paper: Lab for 1PB1 | No. of Credits | : 4 |
| Title of the Paper: THALLOPHYTES , BRYOPHYTES ,PTERIDOPHYTES AND GYMNOSPERMS | | |
| Marks: 40 + 60 = 100 | | |

1. Limnological study of the aquatic microalgae of temple tank, pond and lake.
2. Culture media preparation – Study of succession of algae in lentic waters.
3. Study of the terrestrial algae from red soil, clay soil, sandy soil, wet walls and bark of the trees.
4. Study of the marine seaweeds found in Mandapam and Rameshwaram coastal line.
5. Study of the structure of *Oscillatoria*, *Spirulina*, *Nostoc*, *Anabaena*, *Microcystis* and *Scytonema*.
6. Study of the structure of *Tolypothrix*, *Westiellopsis*, *Cylindrospermum*, *Chlorella*, Desmids and Diatoms.
7. Study of the external and internal structure of macroscopic seaweeds- *Ulva*, *Caulerpa*, *Halimeda* and *Padina*.
8. Study of the external and internal structure of macroscopic seaweeds- *Dictyota*, *Sargassum*, *Polysiphonia* and *Gracilaria*.
9. Isolation and identification of fungi from bread, pickle, soil, seed and dung.
10. Identification and micropreparation of *Rhizopus*, *Mucor*, *Pilobolus*, *Aspergillus*, *Penicillium* and *Trichoderma*.
11. Identification and micropreparation of *Fusarium*, *Curvularia*, *Alternaria*, *Agaricus*, *Polyporus* and *Peziza*.
12. Isolation and identification of ecto and endomycorrhiza from soil.
13. Study of the structure of Crustose, Foliose and Fruticose lichen thallus.
14. Study of external and internal structure of *Marchantia*, *Porella* and *Pellia*.
15. Study of sporophyte and gametophyte structures of *Funaria*.
16. Study of the stele types using permanent slides.
17. Study of external and internal structure of *Equisetum* stem.
18. Study of the structure of *Equisetum* cone.
19. Study of the external and internal structure of *Lygodium* rachis.
20. Study of the structure of *Lygodium* sorus.
21. Study of external and internal structure of *Pteridium* rachis
22. Study of structure of *Pteridium* sorus.
23. Study of external and internal structure of *Ceratopteris* sorus
24. Study of external and internal structure of *Marsilea* rhizome, petiole and sporocarp
25. Study of Fossil slides of Psilophytales and Lepidodendrales
26. Study of fossil slides of Sphenophyllales and Coenopteridales
27. Study of internal structure of *Araucaria* stem.
28. Study of internal structure of *Cupressus* stem.
29. Study of internal structure of *Podocarpus* stem.
30. Study of fossil slides of *Lyginopteris*, *Lagenostoma* and *Medullosa*
31. Collection, identification and submission of at least 25 specimens.
32. Field study for a maximum of 10 days and maintenance of a field-note book.

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| | | |
|---|----------------------|---------|
| Course: M.Sc., Botany | Code No | : 1PBL2 |
| Semester: 1 | No. of Hrs allotted: | 90 |
| Paper: Lab for 1PB2 | No. of Credits | : 4 |
| Title of the Paper: MICROBIOLOGY AND PLANT PATHOLOGY | | |

Marks: 40 + 60 = 100

1. Preparation of media.
2. Isolation and maintenance of pure culture.
3. Acid fast staining.
4. Gram staining.
5. Negative staining
6. Bacterial analysis of water; Testing for coliforms.
7. Presumptive, confirmative and completed test
8. Production of extra cellular enzymes; Catalase and Amylase.
9. Dye reduction test for milk
10. Isolation of microbes from food samples.
11. Root nodule studies-Isolation of Rhizobia, Frankia and Glomus
12. Isolation of plant pathogens from infected plant materials.
13. Study of diseased plant materials – Rust by Puccinia.
14. Red rust and white rust.
15. Leaf spot of groundnut.
16. Mildew and Leaf spot of Banana.
17. Canker and Red rot.
18. Collection of plant pathology specimens – 10 sheets to be valued externally.

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Course: M.Sc., Botany

Code No : 2PB1

Semester: 2

No. of Hrs allotted: 105

Paper: Core

No. of Credits : 5

Title of the Paper: **BIOLOGICAL CHEMISTRY & BIOTECHNIQUES**

Marks: 25 + 75 = 100

Course Objectives:

- To understand the structure & function of the Biomolecules.
- To understand the basic principles of Biotechniques.
- To 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, Urea cycle; 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 – 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, colchicines. Structure and function of Triterpenoids.

Unit- III

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

Unit -IV

Centrifugation techniques: basic principles of sedimentation-Ultracentrifuges: preparative and analytical- types of rotors and applications. pH meter and its biological application. Spectrophotometry: principles, instrumentation and applications . of UV-Visible - IR Spectrophotometry. Chromatographic techniques: principles and applications of Gas-liquid chromatography (GLC) and High performance (pressure) liquid chromatography (HPLC).

Unit –V

Radiolabelling techniques: Properties of different types of radioisotopes used in Biology. Detection, measurement of radioisotopes in biological tissues and cells. Safety guidelines. Electrophoretic techniques: Agarose and PAGE. Histochemical and immunotechniques: Antibody generation, detection of molecules using ELISA. Western blot, Immunoprecipitation, Flow Cytometry.

Text books:

1. Nelson, D.L. and Cox, M.M. 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 Voet, J.H. 1995. Biochemistry. John Wiley and Sons, New York.
4. Marry.K.Campbell. Shawn O. Fawell.2007.Biochemistry. 6th Ed. Thompson.Brooks/cole.USA 781pp.
5. N. Gurumani. 2006. Research Methodology. M.J. Publications. Chennai.

Reference Books:

1. Berg, J.M., Tymoczko, J.L. and Stryer, L. 2001. Biochemistry. Freeman and Company, New York.
2. Lea, P.J. and Leegood, R.C. 2001. Plant Biochemistry and Molecular Biology. John Wiley and Sons, New York.
3. Reginald.H.Garrett,Charles M. Grisham. 2010. Biochemistry. Mary Fimch Publisher. Boston. USA. 1059pp
4. Wilson, K. and Walker, J. 2000. Practical Biochem- Principles and Techniques. Cambridge Uni. Press, Cambridge, U.K.

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| | | |
|---|----------------------|---------------|
| Course: M.Sc., Botany | Code No | : 2PB2 |
| Semester: 2 | No. of Hrs allotted: | 90 |
| Paper: Core | No. of Credits | : 5 |
| Title of the Paper: PLANT PHYSIOLOGY | Marks: | 25 + 75 = 100 |

Course Objectives:

- To understand the physiological processes in plants
- to understand the concept of metabolic activities in plants
- to understand the functional aspects of various processes in plants
- to understand the interaction and functioning of various organelles

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. Absorption of mineral salts – mechanism . Mechanism of organic solute transport: pressure flow mechanism, phloem loading and unloading.

Unit -II

Photosynthesis: Pigment systems in photosystem I and Photosystem II – light reaction - Z-scheme of photosynthetic electron transport chain and Photophosphorylation- Carbon assimilation: C₃, C₄ and CAM pathways- Photorespiration and its significance. Respiration: Glycolysis and TCA cycle – Oxidative Phosphorylation –alternative respiration (Cyanide) - 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- regulations of flowering- Vernalization.

Unit- IV

Dormancy: Seed, bud, and tuber dormancy. Seed germination – hormonal regulation of germination and dormancy. Senescence: Whole plant, leaf, flower and fruit senescence, delay of senescence – Fruiting- mechanism of fruiting – hormonal control of fruiting – climacteric rise – shelf life of tropical fruits.

Unit -V

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

Text books:

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

Reference Books:

1. Bidwell,R.G.S., 1979, II Edition, Plant physiology, McMillan Publishers, New York.
2. Goodwin, F.W. and Mercer, F.I., 1983, II Edition, Introduction to Plant Biochemistry, 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 Wiley & Sons Inc., USA.
5. Lincoln Taiz Eduardo zeiger. 2010. Plant Physiology. Sinauer Associates. UK. 780 pp.
6. Park. S. Nobel. 2009. Physicochemical and environmental plant physiology. 4th ed. Academic press. U.K. 598 pp.

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Course: M.Sc., Botany
Semester: 2
Paper: Elective -2
Title of the Paper: **BASICS OF COMPUTER, BIOINFORMATICS & BIostatISTICS**

Code No : 2PBE(B)
No. of Hrs allotted: 75
No. of Credits : 5
Marks: 25 + 75 = 100

Course Objectives:

- To understand the basic operating system in computers such as MS word and MS excel.
- To get familiarize with the bioinformatics software used in Biology
- To apply statistical tools to analyze data in Biology

Unit -I

Computers- Introduction- Operating systems: DOS, Windows- MS Office. Word, Excel- Powerpoint – Access – Internet and Email- Biological Websites – Literature search. Computer languages: Machine, Assembly and High level languages.

Unit -II

Bioinformatics- Introduction –Classification of Biological databases- Nucleotide sequence data bases, Protein sequence databases, specialized sequence databases. Data Mining of Biological Databases.

Unit III

Sequence Analysis - Global alignments, Local Alignments. - FASTA, BLAST- Multiple sequence alignment - PSI- BLAST.: Phylogenetic Analysis - . Applications of Bioinformatics in various fields.

Unit- IV

Biostatistics: Correlation Analysis- methods of studying Correlation- Graphic and mathematical methods- Carl Pearson- coefficient Correlation.
Regression Analysis- Methods- Regression lines. Regression equations. Theoretical Distributions- Normal, binomial and Poisson Distribution.

Unit -V

Sampling and test of significance- Testing of hypothesis and test of significance. ANOVA - One way –Two way

Text books:

- 1) Attwood, T.K and Parry-Smith.2001. Introduction to Bioinformatics. Pearson Education, Asia, New Delhi.
- 2) Twyman, R.H.2003. Instant notes on bioinformatics, Viva Books Ltd., New Delhi.
- 3) Baxevanis, A.D and Qullette, B.F.F. 2001. Bioinformatics – Practical guide to analyse genes and proteins. Wiley International Science Publication. New York.
- 4) Palanichamy, S. and Manoharan. M. 1994. Statistical methods for Biologists. Palani Paramount Publications, Palani.
- 5) Gupta, S.P. 1977. Statistical methods. 9th edition. S. Chand and sons Publishers, New Delhi.
- 6) Twyman, R.H. 2003. Instant notes on Bioinformatics. Viva Books Ltd., New Delhi

Reference Books:

1. Rosner, B. 2000. Fundamentals of Biostatistics. V edn. Duxbury, USA.
2. Zar, J.H. 2003. Biostatistical analysis. Pearson education. Singapore.
3. Attwood; T.K. and Parry-Smith. 2001. Introduction to Bioinformatics. Pearson Education, Asia, New Delhi.
4. Mount, W. 2001. Bioinformatics - Sequence & Genome analysis. Cold Springer Harber Laboratory Press, N.Y
5. Stout, The World Wide Web – Complete reference, Tata Mc Graw Hill Publishing Co. Ltd., New Delhi.
6. Xavier, C. 2001. World Wide Web Designing with HTML. III reprint. Tata McGraw Hill Pub.Co. New Delhi.
7. Shalini Suri. 2006. Bioinformatics. APH publishing corporation. New Delhi.
8. Calvin Dytham. 2011. Choosing and using Statistics-A Biologist's Guide. 3rd ed. Blackwell Publisher. UK.

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Course: M.Sc., Botany

Code No : 2PBL1

Semester: 2

No. of Hrs allotted: 90

Paper: Lab for 2PB1

No. of Credits : 4

Title of the Paper: **BIOLOGICAL CHEMISTRY & BIOTECHNIQUES**

Marks: 40 + 60 = 100

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 carbohydrate content in plant source.
7. Estimation of Vitamin C (Ascorbic acid) in fruits- titrimetic method.
8. Estimation of anthocyanins.
9. Determination of palmitic acid content.
10. Paper chromatographic identification of amino acids.
11. Paper chromatographic identification of plant pigments.
12. Thin Layer chromatographic identification of sugars.
13. Effect of temperature on nitrate reductase activity.
14. Effect of substrate concentration on nitrate reductase activity.
15. Effect of pH on nitrate reductases activity
16. Effect of inhibitor concentration on nitrate reductases activity
17. Effect of temperature on amylase enzyme on germinating seeds.
18. Effect of substrate concentration on amylase enzyme on germinating seeds.

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Course: M.Sc., Botany

Code No : 2PBL2

Semester: 2

No. of Hrs allotted: 90

Paper: Lab for 2PB2

No. of Credits : 4

Title of the Paper: **PLANT PHYSIOLOGY**

Marks: 40 + 60 = 100

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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
 7. Absorption spectrum of β - carotene.
 8. Effect of temperature on membrane permeability.
 9. Effect of 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 reductases activity (Stress activity).
 16. Differentiation of C_3 and C_4 plants by starch test.

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Course: M.Sc., Botany

Code No : 3PB1

Semester: 3

No. of Hrs allotted: 90

Paper: Core

No. of Credits: 5

Title of the Paper: **ANGIOSPERM TAXONOMY**

Marks: 25 + 75 = 100

Course Objectives:

- To understand the principles of Taxonomy.
- To educate the significance of Binomial Nomenclature and Herbarium.
- To study the floral variation of different taxa.

Unit- I

Principles of Taxonomy: Classification – (a) Artificial – Linnaeus, (b) Natural – Bentham and Hooker, (c) Phylogenetic – Engler and Prantl and (d) Modern – Bessey.

Unit -II

Nomenclature: Principles – ICBN – Typification – Principles of Priority – Effective and valid publication – Citation – Retention choice and Rejection of names – Chemotaxonomy – Numerical taxonomy – Molecular taxonomy – Computer application in systematics: Biosystematics and modern taxonomy.

Unit- III

Study of the Polypetalae families: Magnoliaceae, Menispermaceae, Papaveraceae, Violaceae, Polygalaceae, Tiliaceae, Zygophyllaceae, Geramiaceae, Mimosaceae, Myrtaceae, Meliaceae and Sapindaceae.

Unit-IV

Study of the Gamopetalae families: Sapotaceae, Rubiaceae, Asteraceae, Plumbaginaceae, Apocynaceae, Gentianaceae, Convolvulaceae, Bignoniaceae, Scrophulariaceae and Verbenaceae .

Unit -V

Study of the Monochlamydeae families: Polygonaceae, Amaranthaceae, Aristolochiaceae and Loranthaceae

Study of the Monocotyledons: Hydrocharitaceae, Dioscoreaceae, Arecaceae and Cyperaceae.

Unit VI –

Computer application in Systematics : Biosystematics and modern taxonomy;

Study of economic botany: Ethnobotany and drug discovery from plants.

Text books:

1. Davis, P.H. and Heywood V.H.D. 1963. Principles of Angiosperm Taxonomy. Oliver and Boyd, London.
2. Naik, V.N 1988. Taxonomy of Angiosperms. Tata McGraw-Hill Publishing Company Ltd, New Delhi.
3. Sivarajan, V.V. 1991. Introduction to the principles of plant taxonomy. Oxford and IBH publishing Co. Pvt. Ltd., New Delhi.
4. Datta, S.C. 1988. Systematic Botany. Wiley Eastern Ltd., Madras.
5. Mitra, J.N. 1988. An introduction to systematic Botany and Ecology. The world press Pvt. Ltd. Calcutta.
6. Stace, A.C. 1980. Plant taxonomy and Biosystematics. Edward Arnold, London.
7. Rendle, A.B. 1979. Classification of flowering plants Vol. I & II Vikas.publishing House Ltd., New Delhi.
8. Takhtajan, A. 1980. Outline classification of flowering plants (Magnoliophyta) Botanical Rev. 46; 225-359.
9. Lawrence G. H. 1965. Taxonomy of vascular plants. The Macmillon Company, New York.

Reference Books:

1. Henry, A.N. and Chandra Bose, 1980. Botanical Nomenclature, Today and Tomorrow Publishers, New Delhi.
2. Heywood, V.H., 1976. Plant Taxonomy. Edward Arnold Publishing Ltd., London.
3. Lawrence, H.M., 1967. Taxonomy of Vascular plants. Oxford and IBH publishing Company, New Delhi.
4. Rendle, A.B., 1979. Classification of flowering plants vol. I & II. Cambridge University Press London.
5. Stace, C.A., 1980. Plant Taxonomy and Biosystematics. Edward Arnold Publishing Limited, London.
6. Tod F. Stuessy. 2009. Plant Taxonomy: the systematic evaluation of comparative data. Columbia Uni. Press. N.Y.

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Course: M.Sc., Botany Code No : 3PB2
Semester: 3 No. of Hrs allotted: 90
Paper: Core No. of Credits : 5
Title of the Paper: **BIODIVERSITY AND CONSERVATION** Marks: 25 + 75 = 100

objective:

- To introduce various concepts of biodiversity
- To educate various principles and methods of biodiversity analysis
- To educate for the development of ideas in the biodiversity conservation
- To make involve in the biodiversity conservation

Unit –I

Biodiversity – Categories – Species – Ecosystem and Habitat – Biomes - Genetic – Guild diversity - Biogeographical regions – Terrestrial – Aquatic – Biodiversity Hot spots - Biosphere Reserves – Megabiodiversity nature of India – Biodiversity rich features – Western Ghats – Gulf of Mannar – Vavilo’s Centres of origin of food crops

Unit- II

Biodiversity categories – Alpha, Beta and Gamma Diversity – Organisms relationships relevance to richness and evenness – Competition – Commensalism – Ammensalism – predation – antagonistic - mutualism – parasitism – co-existence - k and r selection of species

Unit -III

Species – concepts - keystone – flagship – dominant – co dominant – pioneer – climax – Indicator richness – theories – Vegetation analysis – Quadrat – transect – Abundance, Density - Dominance indices – Berger and Parker – Simpson – Information Static Indices - Shannon – Brillouin

Unit -IV

Conservation – *In situ* conservation principles – Methods – National Parks – Wildlife sanctuaries – Biosphere Reserves – *Ex-situ* conservation – Botanical and Herbal Gardens – Zoological Parks – Seed orchards – conservation through plant tissue culture – Environment Management and Impact Assessment in biodiversity conservation (concepts only)

Unit- V

Threats – Natural and Anthropogenic – Endemic nature - Invasive species – species introduction - GMOs IUCN’s Red Data Book – Extinction and threat categories – cause for endangered – species loss – Intellectual Property Rights – Conservation Acts – Forest Act – Biodiversity Act – CITES

Text Books:

1. F.B. Mandal & N.C. Nandhi 2009, Biodiversity: Concept, Conservation and Biofuture, Asian Books P. Ltd., New Delhi.
2. S.S. Purohit, Q.J. Shammi, A.K. Agarwal 2009, A Text Book of Environmental Sciences Saraswathi Prohit for Student Edition, Jodhpur.
3. K.V. Krishnamoorthy (2004), Text Book of Biodiversity , Science Publishers,
4. - David William Pearce (1994), The economic value of biodiversity

Reference Books:

1. Dan L. Perlman, Glenn Adelson 2007, Biodiversity: Exploring Values and Priorities in Conservation – Blackwell Publishers, UK
2. Mike J. Jeffries, Michael J. Jeffries 2005, Biodiversity and Conesevation -Routledge Taylor & Francis Group, UK.
3. Peter Stiling 2002. Ecology Theories and Applications – Prantice-Hall of India, New Delhi.
4. D. L. Perlman, G. Adelson 1997, Biodiversity: exploring values and priorities in conservation –Blackwell Publishers, UK

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| | | |
|--|----------------------|--------------|
| Course: M.Sc., Botany | Code No | : 3PBE(F) |
| Semester: 3 | No. of Hrs allotted: | 30 |
| Paper: Elective for non-major students | No. of Credits | : 2 |
| Title of the Paper: FORESTRY | Marks: | 15 + 35 = 50 |

Course Objectives:

- to get familiarize with the Social forestry in India
- to understand the concept of Agro forestry and conservation of Wild Life.

Unit – I

Types of Forests - Social forestry: Objectives of social forestry – afforestation under social forestry programme; important cottage industries based on social forestry – trees for social forestry – Forest organizations. Plantation forestry: Teak, eucalyptus and subabul. Role of remote sensing in forest management.

Unit – II

Agro forestry – objectives – advantages and disadvantages – Energy plantations; recreational forestry – role of botanical gardens, Zoos, National parks and sanctuaries in recreation / conservation of wild life. Role of peoples (chipko) movement in forest conservation.

Text Books:

1. Annu Jalais 2009. Forest of Tigers: People, Politics and environment in the Sundarbans. Roatlendge India publisher.
2. Frederick Franklin Moon. 2010. The Book of Forestry. Appleton and company publication. N.Y. 326 pp.
3. Bhanwar Lal Sharma R. Vishnoi. 2000. Perspective on Social Forestry. Daya publishing house. Delhi. 142 pp.
4. Sunil Puri, Puri, Sunil & Pankaj Panwara, Pankaj Punwar. 2007. Agroforestry: Systems and Practices. New India publishing Agency. New Delhi. 657. Pp.
5. Julian Evans, John W. Turnbull. 2004. Plantation Forestry in the Tropics. 3rd ed. Oxford University press.
6. L. De Vere Burton, 2000. Introduction to Forestry Science. Delmar publishers.
7. T. Krishnamurthy. 1993. Minor Forest products of India. Oxford & IBH publishing Co. Pvt. Ltd. New Delhi.
8. B.S. Chundawat & S.K. Gautam. 1993. Text book of Agroforestry. Oxford & IBH publishing Co. pvt. Ltd. New Delhi.

Reference Books:

1. Jha, L.K. and Sen, P.P. 1991. Social Forestry, Himalaya publication compny, New Delhi
2. Padhi, G.s. 1982. Forestry in India, International Book Distributors, Dehradun
3. Sagreiya, K.P. 1997. Forests and Forestry, National Book Trust of India, New Delhi.
4. Kathryn A. Kohm, Jerry F. Franklin. 1997. Creating Forestry for the 21st Century: The Science of Ecosystem. Island Press. U.S.A. 475 pp.
5. N.H. Ravindranath, K.S. Murali, K.C. Malhotra. 2000. Joint Forest Management and Community Forestry in India. - An Ecological and Institutional Assessment. Oxford and IBH publishing co. pvt. Ltd. New Delhi.

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DEPARTMENT OF BOTANY
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Course: M.Sc., Botany

Code No : 3PBL1

Semester: 3

No. of Hrs allotted: 120

Paper: Lab for 3PB1

No. of Credits : 5

Title of the Paper: **ANGIOSPERM TAXONOMY**

Marks: 40 + 60 = 100

1. Identification of the representatives of the following families: Study of the polypetalous families:

Magnoliaceae, Menispermaceae, Papaveraceae, Violaceae, Polygalaceae, Tiliaceae, Zygophyllaceae, Geraniaceae, Mimosaceae, Myrtaceae, Meliaceae and Sapindaceae, Sapotaceae, Rubiaceae, Asteraceae, Plumbaginaceae, Apocynaceae, Gentianaceae, Convolvulaceae, Bignoniaceae, Scrophulariaceae and Verbenaceae, Polygonaceae, Amaranthaceae, Aristolochiaceae and Loranthaceae, Hydrocharidaceae, Dioscoreaceae, Arecaceae and Cyperaceae

2. Identification of stored/preserved and herbarium specimens.

3. Preparation of two types of dichotomous keys.

4. Identification of the families using punch-cards

4. Submission of 30 herbarium sheets –Valued externally.

5. Field study and maintenance of a field-note book.

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Course: M.Sc., Botany

Code No : 3PBL2

Semester: 3

No. of Hrs allotted: 120

Paper: Lab for 3PB2

No. of Credits : 5

Title of the Paper: **BIODIVERSITY AND CONSERVATION**

Marks: 40 + 60 = 100

1. Vegetation analysis using quadrat method
2. Vegetation analysis using transect method
3. Vegetation analysis using line transect method
4. Vegetation analysis – Frequency, Density, Abundance, Important Value Index
5. Dominance Index – Shannon's Index

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| | | |
|---|----------------------|---------------|
| Course: M.Sc., Botany | Code No | : 4PB1 |
| Semester: 4 | No. of Hrs allotted: | 105 |
| Paper: Core | No. of Credits | : 5 |
| Title of the Paper: MOLECULAR GENETICS | Marks: | 25 + 75 = 100 |

Course Objectives:

To study the theoretical aspects in genetic engineering and Molecular Biology.

To understand the regulation and expression of genes.

Unit -I

Structure and replication of prokaryotic and eukaryotic genome -enzymes involved- structure and replication of eukaryotic chromosome- amplification and rearrangement. Transposable genetic elements in Bacteria- IS elements- eukaryote Maize transposons-Yeast-TY-elements.

Unit- II

Mechanism of mutation. Induced mutations by chemicals, by radiation and by transposable genetic elements. DNA repair Mechanisms. Light-dependent Repair, Excision repair and SOS repair .

Unit -III

Regulation of gene expression in prokaryotes- attenuation and antitermination-induction and repression in prokaryotes. Lac operon: inducible operons, trp-repressible operon-positive control of lac operon by CAP and cyclic AMP-Complex regulation of ara operon

Unit- IV

Regulation of gene expression in eukaryotes- RNA processing- mechanism of regulation in eukaryotes- Eukaryotic transcription units-monogenic-enhancers and silencers modulation of transcription-regulation by methylation-hormonal control-activation of transcription by steroid hormones. Post-transcriptional and translational modification, Signal transduction.

Unit -V

Genetics and Cancer: Cancer and programmed cell death, genetic basis for cancer, Oncogenes-Tumor- Inducing Retroviruses and viral oncogenes, Mutant, cellular Oncogenes and Cancer, Chromosome rearrangements and Cancer-Tumor suppressor gene.

Text books:

1. Snustad and Simmons 2006. Principles of Genetics. John Wiley and Sons (Asia) Pvt. Ltd. New Jersey.
2. Burns, G.W. and Bottino, P.J. 1983. The Science of Genetics. Macmillan Publishing Company, New York.
3. Paul G. Young. 2003. Exploring Genomes. W.H. Freeman, U.K.
4. Watson, J.D. 1987. Molecular Biology of Gene. The Benjamin. Gummings publishing co. inc. California

Reference books:

1. Hopkins, W. 1988. Molecular biology of the gene. Benjamin publishing Company. California.
2. Lewin, B. 2004. Genes VIII. Pearson Prentice Hall, New Jersey.
3. Miglani, G. S. 2002. Advanced Genetics. Narosa Publishing House, New Delhi.
4. Geoffrey m. Cooper, Robert, E. Hansman. 2007. The cell- A Molecular approach, sinauer Associates. USA.

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Course: M.Sc., Botany

Semester: 4

Paper: Core

Title of the Paper: **BIOTECHNOLOGY**

Code No : 4PB2

No. of Hrs allotted: 105

No. of Credits : 4

Marks: 25 + 75 = 100

Course Objectives:

- To study the techniques involved in plant genetic engineering
- To understand the principle of genetic engineering and tissue culture
- to 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, Bacteriophage vectors. Techniques: Types of restriction – Ligation – Techniques of transformation of microbes. Methods of identifying clones: Insertional inactivation – Blotting techniques – Southern, Western blotting colony hybridization. Gene banks and genomic libraries. *Agrobacterium* mediated plant genetic engineering for Glyphosate resistance.

Unit –II

Plant Biotechnology: Plant Tissue culture – Totipotency and plasticity – Media preparation (MS medium) – Explant types – Callus culture – suspension culture – Meristem culture – Micropropagation- Anther and Embryo culture – Organogenesis – Hardening. Somatic hybridization: Somatic embryogenesis and protoplast fusion. Germplasm conservation: Seed bank, Pollen bank.

Unit-III

Agricultural Biotechnology: Transgenic plants for diseases resistance, stress tolerance and strain improvement – Bt Cotton, Golden rice. Molecular farming: Plantibodies, Edible Vaccines, Bioplastics. Biofertilizers: Mass cultivations and application of nitrogenous and phosphatic biofertilizers. Biopesticides.

Unit –IV

Industrial Biotechnology: Fermentor-Design,Types. Microbial fermentation process: Production of industrial alcohol,wine, beer. Production of Amino acids: Glutamic acid (Ajinomoto). Production of organic acids: Citric acid, itaconic acid. Industrial enzymes: Methods of production of amylases and proteases. Production of Antibiotics: Penicillin, Streptomycin. Industrial production of single cell protein: Yeast and *Spirulina*.

Unit -V

Environmental Biotechnology: Biodegradation and Bioconservation. Biomass and Bioenergy: Petrocrops, Gasification, Pyrolysis. Biofuels: Photobiological Hydrogen production (*Euphorbia*, *Hevea* rubber, Algal hydrocarbons). Biogas: Models of biogas plants. Mechanism and technique of biogas production. Sewage and effluent treatment: Activated sludge treatment

Text books:

1. Kumar H.D. 2001. A textbook on Biotechnology. East-west Press, New Delhi.
2. Dubey, R.C.2002. A textbook of Biotechnology. S. Chand and Company, New Delhi.
3. Ignacimuthu, S.J. 1997. Plant Biotechnology. Oxford and IBH Publishing Company, New Delhi.
4. Nirmala,C.B., G. Rajalakshmi, Chandra Karthick. 2009. Plant Biotechnology. MJP publishers,Chennai

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

THIAGARAJAR COLLEGE (AUTONOMOUS) MADURAI-9.
(Re-Accredited with 'A' Grade by NAAC)
DEPARTMENT OF BOTANY
(from 2011-12 batch onwards)

Course: M.Sc., Botany

Semester: 4

Paper: Elective -3

Title of the Paper: **PROJECT**

Code No : PJ

No. of Hrs allotted: 75

No. of Credits : 5

Marks: 40 + 60 = 100

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Course: M.Sc., Botany

Code No : 4PBL1

Semester: 4

No. of Hrs allotted: 75

Paper: Lab for 4PB1

No. of Credits : 4

Title of the Paper: **MOLECULAR GENETICS**

Marks: 40 + 60 = 100

1. Isolation of Genomic DNA from Onion/Cauliflower
2. Isolation of Genomic DNA from microbes
3. Quantitative estimation of DNA by TAB method
4. Agarose Gel Electrophoresis of bacterial and plasmid DNA
5. Cloning of a DNA fragment in a known vector
6. Preparation of competent cells
7. Recombinant screening
8. Isolation of recombinant plasmid
9. Restriction analysis
10. Demonstration of PCR amplification
11. Isolation of total RNA
12. Colorimetric estimation of RNA
13. Electrophoretic separation of proteins
14. Demonstration of Western blotting
15. Isolation of spontaneous mutants by gradient plate technique
16. Bacterial conjugation
17. Cytotoxicity – Onion root tip squash.

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DEPARTMENT OF BOTANY
(from 2011-12 batch onwards)

Course: M.Sc., Botany

Code No : 4PBL2

Semester: 4

No. of Hrs allotted: 90

Paper: Lab for 4PB2

No. of Credits : 4

Title of the Paper: **BIOTECHNOLOGY**

Marks: 40 + 60 = 100

1. Fermentation by Yeast – Estimation of alcohol content.
2. Citric acid production by *Aspergillus niger* – estimation of citric acid content.
3. Study of cultured cells – *Datura*, *Daucas*, *Nicotiana*.
4. Isolation of cellulolytic organisms by enrichment culture method.
5. Measurement of yeast biomass production by turbidity method.
6. Measurement of bioconversion efficiency of bacteria, yeast and fungi.
7. Immobilization of microbes in calcium alginate beads.
8. Induction of callus.
9. Effect of biofertilizers on plant biomass.
10. Biodegradation of cellulosic wastes.
11. Isolation of nitrogen fixing and phosphate solubilizing bacteria from soil.
12. Vermicomposting.
13. Alcohol fermentation by immobilized yeast cells.
14. Production of itaconic acid by *Aspergillus terreus*.

THIAGARAJAR COLLEGE (AUTONOMOUS) MADURAI-9
DEPARTMENT OF BOTANY

Certificate and Diploma Courses offered by Botany Department and their syllabus
(For those admitted in June 2011 and later)

| S. No. | Class | Semester | Code | Title of the paper | Contact hrs | Valuation Scheme | | |
|--------|-------|----------|------|--|-----------------------------|------------------|------|-------|
| | | | | | | Int. | Ext. | Total |
| 1. | B.Sc | 3 & 4 | | <u>Certificate Course</u> <u>in</u> <u>-Mushroom Cultivation</u> | 2 / week; 20 / Sem | 25 | 75 | 100 |
| 2. | M.Sc | 2 | | <u>Diploma course in</u> <u>Medicinal Plants</u> | | 25 | 75 | 100 |
| 3. | M.Sc. | 3 | | Paper-1 Medicinal Botany | 3 / week; 30 / Sem | 25 | 75 | 100 |
| | | | | Paper - 2 Herbal Technology | 3 / Week; 30 / Sem | | | |

Certificate course in **MUSHROOM CULTIVATION**
(For those admitted in June 2011 and later)

CLASS: B.Sc., BOTANY
SEMESTERS- III & IV
Code No:
Total Marks: 100

Contact hours per semester : 20
Contact hours per week : 2
Int. Marks: 25
Ext. Marks: 75

Objectives:

- To acquire the basic knowledge and develop suitable skills involved in mushroom cultivation.
- To realize the nutritive value of mushrooms ; To learn to occupy oneself during leisure time.

Unit – I Introduction- history of mushroom cultivation- classification, internal and external structure of mushroom. types of mushrooms- edible and non-edible, uses of mushrooms.

Unit – II Cultivation of mushroom- spawn production, environmental and nutritional requirements, cultivation methods, storage, preservation and uses of : 1. Paddy straw mushroom (*Volvariella*) 2. Oyster mushroom- (*Pleurotus*) 3. Button mushroom- (*Agaricus bisporus*)

Unit – III Cultivation – Conditions for tropical countries, isolation, Spawn production, growth media, Spawn running and harvesting. Factors affecting cultivation of Mushrooms.

Unit - IV Diseases and post harvest technology – Insect pests, nematodes, mites, viruses, fungal competitors and other important diseases. Post harvest technology – harvesting, freeze drying, sun drying, blanching, steeping, canning, pickling, packaging.

Unit V Short term and long term storage, marketing recipes from Mushroom. Common Indian mushrooms – distribution, production level, economic return, foreign exchange from mushroom cultivation countries and international trade. Prospects and scope of mushroom cultivation in small scale industry.

Text Books:

1. Nita Bahl. 2002. Handbook on Mushroom. Vijay Pramlani for Oxford & IBH publishing co. Pvt. Ltd. New Delhi.
2. Sharma V.P. 2006. Diseases and pests of Mushrooms. IBH publishers and distributors. New Delhi.

Reference Books:

1. Singh, 2005. Modern Mushroom cultivation. International Book Distributors. Dehradun
2. Suman, 2005. Mushroom cultivation. Processing and uses. IBH publishers and Distributors. New Delhi.

THIAGARAJAR COLLEGE (AUTONOMOUS) MAUDURAI-9
DEPARTMENT OF BOTANY
(For those admitted in June 2011 and later)
DIPLOMA COURSE IN MEDICINAL PLANTS

CLASS: M.Sc

SEMESTER- II

Contact hours per week : 3

Contact hours per semester : 30

Code No:

PAPER – 1 - **MEDICINAL BOTANY**

Int. Marks: 25

Ext. Marks: 75

Total Marks: 100

Objectives:

- To motivate the students to identify and make use of medicinal plants.

Unit –I

Medicinal Botany – History, importance, present status and future prospects. Introduction to system of medicines - siddha, ayurveda, homeopathy and unani, development and control; bio-resource of botanical medicine – terrestrial and aquatic origin.

Unit – II

Medicinal plant diversity, distribution, availability; systematic of medicinal plants and allied drug – medicinal plants classification – morphology, pharmacognosy, chemical compounds.

Unit – III

Study of the following plants with reference to the habit, systematic position, morphology of useful parts; cultivation, collection and drug preparation, utilization of *Tylophora asthmatica*, *Digitalis purpurea*, *Ocimum sanctum*, *Catharanthus roseus*, *Phyllanthus amarus* and *Andrographis paniculata*..

Unit - IV

Adulteration of crude drugs- ethods of adulteration, type of adulteration, detection methods; major medicinal plants and its adulterants (*Gymnema sylvestre*, *Curcuma langa*, *Piper nigrum*, *Cassia senna* and *Withania somnifera*)..

Unit – V

Conservation of medicinal plants – *in situ* and *ex situ* – herbal gardens, sacred groves, conservation through biotechnology and genetic engineering; medicinal plant policy and IPR in India.

Text Books:

1. Srivastava, A.K. 2006. Medicinal plants, International Book Distributors, Dehradun.
2. Yoganarasimhan, S.N. 2000. Medicinal plants of India, Vol.2. Tamil Nadu, Inderline Publishing Private Ltd., Bangalore., Dehra Dun and Michigan.
3. Joshi, S.G. 2000. Medicinal Plants. Oxford and IBH company private Ltd., New Delhi.

Reference Books:

1. Bhattacharjee, S.K. 2004. Handbook on Medicinal Plants. Pointer Publishers, Jaipur.
2. Farooqi A.A & Sreeramu. B.S. 2001. Clultivation of Medicinal and Aromatic Crops, University Press.
3. Pharmacognosy – Kokate et. al., (1994). Nirali Prakashan

THIAGARAJAR COLLEGE (AUTONOMOUS) MAUDURAI-9
DEPARTMENT OF BOTANY
(For those admitted in June 2011 and later)
DIPLOMA COURSE IN MEDICINAL PLANTS

CLASS: M.Sc

SEMESTER- III

Contact hours per week : 3

Contact hours per semester : 30

Code No:

PAPER – 2 - **HERBAL TECHNOLOGY**

Int. Marks: 25

Ext. Marks: 75

Total Marks: 100

Objectives:

- To educate medicinally important plants.
- To educate the significance of health foods and condiments.
- To study the plant constitutions – Alkaloid, Terpenoids & Glycosides

Unit –I

Introduction and classification of medicinal plants; poisonous plants; Ethnobotany ; myth and drug discovery; Indian trade – resources of medicinal and aromatic plants; homemade medicine (juice, infusion, paste, tincture, soup, tonic, decoction, medicated oil), herbal active principles in recent pharmaceutical industry. .

Unit – II

Herbals in cosmetic industry and commercial products – face creams, oral cares (mouth wash, tooth paste, tooth powder), flavor and fragrance; single and polyherbal formulations of drugs – for nutritional, tropical and sub-tropical diseases and ailments (skin diseases, diabetics, laxatives, fever, cold and cough, urinary infection, etc.).

Unit – III

Aroma therapy – introduction and significance, extraction procedure of aroma or essential oil from plants. Eucalyptus oil, Turpentine oil, Citronella oil, Sandal wood oil, Geranium oil, Winter green oil, Menthol, Clove oil.

Unit – IV

Quality control of herbal raw materials, extracts and final products – Pharmacognosy and biochemistry; identification, solubility (water and ethanol), total ash, acid insoluble ash, pH heavy metal analysis, microbial limit; Qualitative and Quantitative identification and estimation of active principle.

Unit – V

Herbal industrial process – standard operating procedures (SOPs)- grinding, formulation, mixing, capsulation and packing; clean air environment – sterilization and cleaning of work space and machinery; Food and Drug (FDA) certification bodies (national and international level) – National rules and regulation on herbal products.

Text Books:

1. Srivastava, A.K. 2006. Medicinal plants, International Book Distributors, Dehradun.
2. Yoganarasimhan, S.N. 2000. Medicinal plants of India, Vol.2. Tamil Nadu, Inderline Publishing Private Ltd., Bangalore., Dehra Dun and Michigan.
3. Joshi, S.G. 2000. Medicinal Plants. Oxford and IBH company private Ltd., New Delhi.

Reference Books:

1. Bhattacharjee, S.K. 2004. Handbook on Medicinal Plants. Pointer Publishers, Jaipur.
2. Farooqi A.A & Sreeramu. B.S. 2001. Cultivation of Medicinal and Aromatic Crops, University Press.
3. Pharmacognosy – Kokate et. al., (1994). Nirali Prakashan

THIAGARAJAR COLLEGE (AUTONOMOUS) MAUDURAI-9
DEPARTMENT OF BOTANY
BACHELOR OF SCIENCE IN BIOTECHNOLOGY (SF)
COURSE STRUCTURE (w.e.f 2011-12 batch onwards)

SEMESTER –I

| Code No. | Subject | Contact Hrs/ Week | Credits | Total No. Of Hrs Allotted | Max Marks CA | Max Marks SE | Total |
|----------|--|-------------------|---------|---------------------------|--------------|--------------|-------|
| P111 | Part I Tamil | 6 | 3 | 90 | 25 | 75 | 100 |
| P211 | Part II English | 6 | 3 | 90 | 25 | 75 | 100 |
| SMB11 | Core Paper -1 General Microbiology | 4+2 | 5 | 90 | 25 | 75 | 100 |
| SMB12 | Core Paper 2: Immunology | 4+2 | 5 | 90 | 25 | 75 | 100 |
| SNBSE1 | Skill based Elective -1: Clinical Lab Technology | 2 | 2 | 30 | 15 | 35 | 50 |
| SNBSE2 | Skill based Elective -2: Biostatistics | 2 | 2 | 30 | 15 | 35 | 50 |
| ES | Environmental studies | 2 | 2 | 30 | 15 | 35 | 50 |
| | Total | 30 | 22 | 450 | | | |

SEMESTER –II

| Code No. | Subject | Contact Hrs/ Week | Credits | Total No. Of Hrs Allotted | Max Marks CA | Max Marks SE | Total |
|----------|---|-------------------|---------|---------------------------|--------------|--------------|-------|
| P121 | Part I Tamil | 6 | 3 | 90 | 25 | 75 | 100 |
| P221 | Part II English | 6 | 3 | 90 | 25 | 75 | 100 |
| SMB21 | Core Paper -3:Basics of Computer and Bioinformatics | 4+2 | 4 | 90 | 25 | 75 | 100 |
| SMB22 | Core Paper 4: Marine Biotechnology | 4+2 | 4 | 90 | 25 | 75 | 100 |
| SMBSE3 | Skill based Elective -3: Nanobiotechnology | 2 | 2 | 30 | 15 | 35 | 50 |
| SMBSE4 | Skill based elective -4: Microscopy and Microtechniques | 2 | 2 | 30 | 15 | 35 | 50 |
| VE | Human Rights and Value Education | 2 | 2 | 30 | 15 | 35 | 50 |
| SMBL21 | Core Practical I –(for SMB11,SMB12,SMB21 & SMB22) | | 8 | | 40 | 60 | 100 |
| | Total | 30 | 28 | 450 | | | |

SEMESTER –III

| Code No. | Subject | Contact Hrs/ Week | Credits | Total No. Of Hrs Allotted | Max Marks CA | Max Marks SE | Total |
|----------|---|-------------------|---------|---------------------------|--------------|--------------|-------|
| P131 | Part I Tamil | 6 | 3 | 90 | 25 | 75 | 100 |
| P231 | Part II English | 6 | 3 | 90 | 25 | 75 | 100 |
| SMB31 | Core Paper -5 : Molecular Biology | 3+2 | 4 | 75 | 25 | 75 | 100 |
| SMBE1 | Elective paper- I :Infectious Diseases | 5 | 3 | 75 | 25 | 75 | 100 |
| SMBNE1 | Non-major Elective –I :Vocational Biotechnology | 2 | 2 | 30 | 15 | 35 | 50 |
| SAB31 | Allied –I :Analytical Biochemistry | 4+2 | 4 | 90 | 25 | 75 | 100 |
| | Total | 30 | 19 | 450 | | | |

SEMESTER –IV

| Code No. | Subject | Contact Hrs/ Week | Credits | Total No. Of Hrs Allotted | Max Marks CA | Max Marks SE | Total |
|----------|--|-------------------|---------|---------------------------|--------------|--------------|-------|
| P141 | Part I Tamil | 6 | 3 | 90 | 25 | 75 | 100 |
| P241 | Part II English | 6 | 3 | 90 | 25 | 75 | 100 |
| SMB41 | Core Paper -6 :Genetic Engineering | 3+2 | 4 | 75 | 25 | 75 | 100 |
| SMBE2 | Elective Paper-2 :Genomics | 5 | 3 | 75 | 25 | 75 | 100 |
| SMBNE2 | Non-major Elective-2: Food Processing Technology | 2 | 2 | 30 | 15 | 35 | 50 |
| SMBL41 | Core Practical 2 –(for SMB31 & SMB41) | | 4 | | 40 | 60 | 100 |
| SAB41 | Allied –II: Biomolecules | 4+2 | 4 | 90 | 25 | 75 | 100 |
| SABL41 | Allied Practical-1 (for SAB31 & SAB41) | | 2 | | 25 | 75 | 100 |
| | Total | 30 | 25 | 450 | | | |

SEMESTER –V

| Code No. | Subject | Contact Hrs/ Week | Credits | Total No. Of Hrs Allotted | Max Marks CA | Max Marks SE | Total |
|----------|--|-------------------|---------|---------------------------|--------------|--------------|-------|
| SMB51 | Core Paper -7: Plant Biotechnology | 4+4 | 5 | 120 | 25 | 75 | 100 |
| SMB52 | Core Paper-8: Industrial Biotechnology | 5+4 | 5 | 135 | 25 | 75 | 100 |
| SMBE3 | Elective-3 : Proteomics | 5 | 3 | 75 | 25 | 75 | 100 |
| SMBSE5 | Skill based Elective-5: Basics of Metabolic pathways | 2 | 2 | 30 | 15 | 35 | 50 |
| SMBL51 | Core Practical-3 (for SMB51 & SMB52) | | 4 | | 40 | 60 | 100 |
| SAB51 | Allied III – Cell Biology and Physiology | 4+2 | 4 | 90 | 40 | 60 | 100 |
| | Self-study paper – Botanical World | | | | 15 | 35 | 50 |
| | Total | 30 | 23 | 450 | | | |

SEMESTER –VI

| Code No. | Subject | Contact Hrs/ Week | Credits | Total No. Of Hrs Allotted | Max Marks CA | Max Marks SE | Total |
|----------|---|-------------------|---------|---------------------------|--------------|--------------|-------|
| SMB61 | Core Paper -9 : Animal Biotechnology | 6+6 | 5 | 180 | 25 | 75 | 100 |
| SMB62 | Core Paper -10: Environmental Biotechnology | 6+4 | 5 | 150 | 25 | 75 | 100 |
| SMBSE6 | Skill based Elective-6 : Biosafety and Intellectual Property Rights | 2 | 2 | 30 | 15 | 35 | 50 |
| SMBL61 | Core Practical 4 –(for SMB61 & SMB62) | | 4 | | 40 | 60 | 100 |
| SAB61 | Allied IV–.Genetics and Evolution | 4+2 | 4 | 90 | 25 | 75 | 100 |
| SABL61 | Allied Practical II(for SAB51 & SAB61) | | 2 | | 40 | 60 | 100 |
| | Part-V Extension activities | | 1 | | | | |
| | Total | 30 | 23 | 450 | | | |

Scheme of Examination:

Core, Allied and Elective papers:

Theory : Internal – 30 Marks (Test 25 marks; duration 2 Hrs + Assign. 5 marks)

External –70 Marks (Duration 3 Hrs.)

Practical : Internal (continuous assessment – 50 marks)

External- 50 marks (Duration 3 Hrs.)

Skilled based, Non major Elective, ES and VE Papers:

Theory : Internal – 15 Marks (Test 10 marks; duration 1 Hrs + Assign. 5 marks)

External –30 Marks (Duration 2 Hrs.)

A) Consolidation of Contact Hours and Credits: UG Biotechnology (S.F)

| Semester | Contact Hrs / Week | Credits |
|----------|--------------------|---------|
| I | 30 | 22 |
| II | 30 | 28 |
| III | 30 | 19 |
| IV | 30 | 25 |
| V | 30 | 23 |
| VI | 30 | 22 |
| Part V | | 01 |
| Total | 180 | 140 |

B) Curriculum Credits : Partwise

Part ITamil(4 x 3 = 12).....12 Credits
 Part IIEnglish...(4 x 3 = 12).....12 Credits

Part III

Core.....(10+[8+8]+4+[4+4]+[10+4]+[10+4] = 66 Credits

Allied.....Chem. 4+ [2+4] + IMB 4+ [2+4] =20 Credits

Elective3+3+3 = 9 Credits

Part IV

Non major Eletive 2+2 =4 Credits

Skill based Elective 4+4+2+2.....= 12 Credits

Value Education= 2 Credits

Environmental Studies=.2 Credits

Part V

..... = 1 Credits

Total = 140 credits

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DEPARTMENT OF BOTANY
(from 2011-12 batch onwards)

Course: B.Sc., Biotechnology (S.F) Code No : SMB11
Semester: 1 No. of Hrs allotted: 90
Paper: Core 1 No. of Credits : 5
Title of the Paper: **GENERAL MICROBIOLOGY**

Marks: 25 + 75 = 100

Course Objective

To get an exposure to the classification of microorganisms.

To be aware of microbial structure and their role.

To motivate the students to acquire more knowledge about the importance of microbes.

Unit :I

Introduction to microbes: Prokaryotes & Eukaryotes - Algae, fungi, protozoa, and mycoplasma. Important milestones in microbiology: spontaneous generation of microbes- 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), glycogens, ribosomes, nucleoid and endospore - cell wall structure. Culture media: complex & defined media, differential and enriched media- pure culture technique- sterilization methods- Physical and chemical methods.

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 based on DNA and RNA. Plant virus (TMV), Bacteriophage (T4), Animal virus (Pox), viroids and prions.

Text Books:

1. Sharma, P.D. 2004. Microbiology, Second edition. Rastogi publication, Meerut.
2. Daniel Lim. 1998. Microbiology, Second edition. McGraw Hill publications, New York.
3. Pelczar, M. J. Jr., E. C. S. Chan. and N. R. Krieg. 2001. Microbiology, 5th edition. Tata Mc Graw Hill publication, New Delhi. 900pp.
4. Stanier, R. Y. and J. L. Ingraham. 1987. General microbiology, 5th edition, Macmillan press Ltd. London.

Reference Books:

1. Prescott, L.M., J. P. Harley and D. A. Klein. 2003. Microbiology 5th Edition. McGraw Hill, New York.
2. Atlas, R. M. 1998. Principles of Microbiology, First edition. Mosby yearbook publication, Missouri.
3. James D.Kettering Craig A. Seheult. 2010. Microbiology: Pretest self-assessment and review 13th edition. McGraw Hill New York. Inc.400pp

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DEPARTMENT OF BOTANY
(from 2011-12 batch onwards)

Course: B.Sc., Biotechnology (S.F)
Semester: 1
Paper: Core 2
Title of the Paper: **IMMUNOLOGY**

Code No : SMB12
No. of Hrs allotted: 90
No. of Credits : 5
Marks: 25 + 75 = 100

Course Objective:

- To understand the basic principles of immunology.
- To become aware of some of the applied aspects related to human health.
- To learn certain basic immunological techniques.

UNIT: 1

Elements of immunology – Primary and secondary lymphoid organs, Thymus, Bone marrow, Bursa of Fabricius, lymph node and spleen. Cells of the lymphoreticular system. Antigen, antigenicity, epitopes and haptens. Immunoglobulins - structure, functions, classes, isotypes, allotypes and idiotypes. Complement system, components, nomenclature, and activation of complement-classical and alternate pathway. Complement fixation test.

UNIT: 2

Types of immunity: innate and acquired immunity – active and passive immunity - Humoral immunity and cell-mediated immunity. Lymphokines and cytokines. T-cell and B-cell receptors. Antigen processing and presentation. Antigen recognition. Interaction of T-cell and B-cell. Immunological memory – regulation of immune response – immunological tolerance.

UNIT: 3

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 : 4

Theories of antibody formation. Antibody diversity- Mechanism contributing diversity. Class switching. MHC complex-gene organization. HLA genes class I & class II antigens: structure and function - Histocompatibility testing. Transplantation-types, graft versus host reactions.

UNIT: 5

Hypersensitivity- Types. Autoimmunity. Immunodeficiency disorders- B-cell and T-cell deficiencies, secondary immunodeficiency diseases (AIDS). Immunoprecipitation, Immunoelectrophoresis, Immunoblotting, Radio immunoassay. ELISA, Avidin- biotin mediated assay, Immunohistochemistry and immunofluorescence.

Text Books:

1. Rao, C.V. 2002. Introduction to Immunology. Narosa publishing House, Delhi.
2. Abbas, L. And Prber. 1997. Essentials of Immunology. W.B Saunders Company New York.
3. Tizard, I. R. 1998. Immunology: An Introduction, 4th edition. W.B. Saunders Company, Philadelphia.

REFERENCE BOOKS:

1. Abbas, A.K. 2004. Basic Immunology 2nd edition. Saunders – Elsevier, Philadelphia
2. Kuby, 1997. Immunology 3rd edition. Freeman Publishers, New York.
3. Klaus.D.Elger. 2009. Immunology: understanding the immune system. Wiley-Blackwell Inc. N.Y. 726pp

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DEPARTMENT OF BOTANY
(from 2011-12 batch onwards)

Course: B.Sc., Biotechnology (S.F) Code No : SNBSE1
Semester: 1 No. of Hrs allotted: 30
Paper: Skill based Elective-1 No. of Credits : 2
Title of the Paper: **CLINICAL LABORATORY TECHNOLOGY**

Marks: 15 + 35 = 50

Course Objectives:

To understand the study of different parameters involved in normal health.

To learn the different methods of analyzing urine and sputum sample.

Unit I

Haematology: Composition of Blood – Plasma and corpuscles – cell study- counting of cells – TC and DC, Platelets, FSR, Hb, BT & CT.

Blood Banking: Rh Typing – Slide test, Blood transfusion – Compatibility testing. Cholesterol, Bilirubin.

Serology: Widal test, VDRL, Rheumatoid factor, A.S.O. titre. Blood culture and sensitivity.

Unit II

Urine and Sputum:

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.

Pregnancy Test

Urine – Microbial culture and sensitivity.

Sputum – Microbial analysis, Culture and sensitivity.

Text Book:

1. Sood, R, 1999, Medical Laboratory Technology – methods and interpretations – Fifth edition, Jaypee, New Delhi.
2. Mukherjee, L.K. 1988, Medical Laboratory Technology – Vol.3 – 2nd ed. – Hill Publishing Ltd., New Delhi.
3. Connie R. Mahon. Diane G. Tice. 2006. Clinical Laboratory Immunology. Pearson Prentice Hall. 325 pp.

Reference Books:

1. Rapael, S.S, 1983, Lynch Medical Laboratory Technology, Fourth edition, W.B. Saunders Co, Singapore.
2. Woohan, I.D.P., Heather Freeman, 1990, Micro Analsis in Medical biochemistry, sixth edition, Churchil
3. Livingstone Publishing Ltd., USA.
4. John Ridley 2010. Essentials of clinical laboratory science. CLIA. Compliance guide. [www.G2intelligence](http://www.G2intelligence.com). Com.
5. 4. 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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DEPARTMENT OF BOTANY
(from 2011-12 batch onwards)

| | | |
|--|----------------------|--------------|
| Course: B.Sc., Biotechnology (S.F) | Code No | : SNBSE2 |
| Semester: 1 | No. of Hrs allotted: | 30 |
| Paper: Skill based Elective-2 | No. of Credits: | 2 |
| Title of the Paper: BIOSTATISTICS | Marks: | 15 + 35 = 50 |

Course Objective:

To learn the basic statistical methods

To understand the application of statistics in biology

Unit I

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.

Unit II

Correlation and regression: Correlation analysis – types of correlation – Significance test of correlation coefficient, Liner regression analysis - Significance test of regression coefficient. ANOVA: One way ANOVA.

Text Books:

- 1.Khan, I.A. and Khanum, A. 2004. Fundamentals of Biostatistics Ukaazz publications, Hyderabad.
- 2.. Zar J.H. 2003. Biostatistical analysis, Pearson education, Singapore.

Reference Books:

1. Bailey, N.J.J. 1994. Statistical Methods in Biology, Cambridge University
2. Forthofer, R.N. and Lee, E.S. 2006. Introduction to Biostatistics, Academic press.

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DEPARTMENT OF BOTANY
(from 2011-12 batch onwards)

| | | |
|--|----------------------|--------------|
| Course: B.Sc., Biotechnology (S.F) | Code No | : ES |
| Semester: 1 | No. of Hrs allotted: | 30 |
| Paper: ES | No. of Credits | : 2 |
| Title of the Paper: ENVIRONMENTAL STUDIES | Marks: | 15 + 35 = 50 |

Course objectives:

- to understand the structure and functions of ecosystem
- to understand the sources, effects and control measures of various types of pollutants
- to know the phytoremediation of environment

Unit-I

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

Unit-II

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

Text Books:

1. Yogendra N. Srivastava, Environmental Pollution, Ashigh Publishing House. 1998.
2. Kanagasabai C.S. Environmental Studies. Rasee publishers. 2005

Books for Reference:

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

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Course: B.Sc., Biotechnology (S.F) Code No : SMB21
Semester: 2 No. of Hrs allotted: 90
Paper: Core 3 No. of Credits : 4
Title of the Paper: **BASICS OF COMPUTER AND BIOINFORMATICS**

Marks: 25 + 75 = 100

Course Objective:

- To understand the role of computer in biological research.
- To learn about the basics of computing , internet and literature Search.
- To have training in biological databases and types of data analysis.

Unit I

Components of computer: input / output devices, storage devices, Graphic devices. Program of representation of information – classification and characteristics of computers. Operating system: MS, DOS & Windows. Networks: Intranet, Internet - LAN – creation and management of e-mail Id.

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 – cell referencing function – cell errors – workbook security – data analysis – using lists – formatting work sheets – printing –charts – graphs. MS Power Point.

Unit III

Introduction to Bioinformatics – Emerging areas in Bioinformatics – Scope of Bioinformatics – useful Bioinformatics web sites WWW. Acquiring and using of public data bases.

Unit IV

Databases: Types of databases – Biological databases. DNA data bases, Protein data base – primary,secondary and composite databases – Retrieval of databases – FASTA, BLAST – types of Blast.

Unit V

.Sequence analysis – DNA sequence analysis. Sequence alignment – Multiple sequence analysis – CLUSTAL W. Phylogenetic analysis – Phylo draw analysis of 3D structure of DNA & Proteins using RASMOL

Text Books

1. Sundararajan, S. and R. Balaji. 2002. Introduction to Bioinformatics. Himalaya Publishing house, Bangalore.
2. Kothekar, V. 2004. Introduction to Bioinformatics. Dhruv Publications, New Delhi.
3. Sanjay Saxena. 2003. First course on computers. Vikas publishing house Pvt. Ltd., New Delhi.
4. Raja Ram, F.V. 2003. Fundamentals of Computers. Printice – Hall of India Pvt. Ltd., New Delhi.
5. Rawlings, R.J. 1986. Software Directory for Molecular Biologists. Stockton press, Mac Millan publishers, New Delhi.

Reference Books:

1. Cohen, N.C. 2006. Guide book on molecular modeling in drug design. Elsevier, New Delhi.
2. P.K. Singh. 2010. Basics of computer- V.K. (India) Enterprises. New Delhi.

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Course: B.Sc., Biotechnology (S.F) Code No : SMB22
Semester: 2 No. of Hrs allotted : 90
Paper: Core 4 No. of Credits : 4
Title of the Paper: **MARINE BIOTECHNOLOGY**

Marks: 25 + 75 = 100

Course objective:

- To understand the ecological importance of oceanic habitat.
- To 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 - Water 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* (Nori or Laver), *Gracilaria* (Kanji Pasi), *Undaria* (Wakame), *Laminaria* (Kombu), *Hypnea* (Sem Pasi) and *Ulva* (Sea lettuce) 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:

1. Austin. 1992. Marine Microbiology. Cambridge press. London
2. Raymont. J. 1963. Plankton and productivity in the Ocean, Pergamon press. London
3. Venkataraman, G.S. 1974. Algae: Form and Function. Today's & Tomorrow's publishers, New Delhi.
4. Imai, LT. 1982. Progress in shallow sea culture techniques of seaweed culture. Tokyo: Koseisha Koseika publishers (English translation) pp.111.
5. Sundaralingam, V. 1991. Marine Algae, Bishan Singh and Mahendra Pal Singh Publishers, Dehradun.

Reference Books:

1. Venkataraman, L.V. 2002. Application of algal Biotechnology in the next millennium. In: A. Anand (ed.) Algal research in India. Bishan Singh, M.S., Dehradun, India. pp. 7-27.
2. Subramanian G. 1998. Marine Cyanobacteria for feed, fine chemicals & Pharmaceuticals. pp. 282-286. In: G. Subramanian, B.D. Kaushik & G.S. Venkataraman (eds.) Cyanobacterial Biotechnology. Oxford IBH Co. Pvt. Ltd., New Delhi. ISBN 81-2041269-9.
3. Subba Rangaiah, G. 1999. Recent trends in Algal Research. Publisher-Marine Algal Laboratory. Visakapatnam. A.P.
4. Krishnamurthy, V. 2000. Algae of India and neighbouring countries. Oxford & IBM Publ. pp. 203

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Course: B.Sc., Biotechnology (S.F) Code No : SMBSE3
Semester: 2 No. of Hrs allotted: 30
Paper: Skill based Elective-3 No. of Credits : 2
Title of the Paper: **NANOBIOTECHNOLOGY**

Marks: 15 + 35 = 50

Course Objectives:

To understand the connection between Nanotechnology and Biology.
To understand the principal properties to explore nanomaterials.
To understand the difference between electron & scanning probe microscope.

Unit I

Nano materials and properties: Nanoscience, Nanoparticles, Nanotechnology, Bucky ball, Gold nanoparticles, Quantum dots, Nano biosensor, Nano drug administration – oral, Nasal and ocular administration.

Unit II

Application of Nano in biology: Fluorescent biomarker imaging – immuno gold labeling – diagnostic application – analytical application. Atomic force microscope Scanning Probe and Scanning Tunneling Microscopes. Synthesis of nanoparticles.

Text Books:

1. Pradeep. T. 2008, Nano: The Essentials – understanding Nanoscience and Nanotechnology, Tata McGraw – Hill Publishing Company Ltd, New Delhi.
2. Mick Wikon, Kamali kannangara, Geoffsmith, Michella Simmons and Burkho Raguse, 2005. Nanotechnology: Basic Science and Energy Technologies Overseas Press.

Reference Books:

1. Davids. Goodsell and Wiely – Liss, 2004. Bionanotechnology: Lessons from Nature.
2. Christo F M. Niemeyer and Mirkin, C.A. 2004. Nanobiotechnology: Concepts, Applications and Perspectives Wiely – Veh, Weinheim.
3. Chad. A. Mirkin. Christof. M. Niemeya. 2007. Nanobiotechnology II. Wiley-Vch verlag GmbH & Co. KGaA. 432 pp

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Course: B.Sc., Biotechnology (S.F)

Code No : SMBSE4

Semester: 2

No. of Hrs allotted: 30

Paper: Skill based Elective-4

No. of Credits : 2

Title of the Paper: **MICROSCOPY AND MICROTECHNIQUES**

Marks: 15 + 35 = 50

Course Objectives

To understand the principle, and mechanism involved in different microscopes.

To learn the methods of preparing stains for microscopic study.

Unit I

Microscopy: Simple and Compound microscope, Light, Dark field, Phase contrast, Electron microscopy – Scanning and Transmission – Principles and applications. Cytophotometry flow cytometry.

Unit 2

Microtechnique: Preparation of specimen for light microscope. Preparation of specimen for SEM and TEM – Fixation Sectioning Clearing, Staining – Mounting – Use of ultra microtome. Freeze – drying and Freeze substitution.

Text Books:

1. Gurumani, N. 2006. Research Methodology for Biological Sciences, 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. Tata MC Graw – Hill Publishing Company Ltd. New Delhi.
2. Culter, D.F. 1978. Applied plant anatomy. Longman, London

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Course: B.Sc., Biotechnology (S.F)

Code No : VE

Semester: 2

No. of Hrs allotted: 30

Paper: VE

No. of Credits : 2

Title of the Paper: **HUMAN RIGHTS AND VALUE EDUCATION**

Marks: 15 + 35 = 50

Course Objective

To learn Human Rights and meaning of value education.

Unit –I

Meaning of Human rights-Evolution of Human rights-Types of Human rights-Civil, Political, Economical, Social and Cultural. Human rights in India. Outstanding features of our constitution. Preamble-Fundamental rights. Directive Principles of State Policy. Fundamental duties. Consumer rights in India.

Unit-II

Meaning of Value education-Objectives of Value Education. Need and importance. Goals of Education and life. Ethics and Culture. Good habits. Role of Educational Institutions.

Text Books:

1. National Council for Teacher Education, Human rights and National values, Self learning module, Volumes I-III New Delhi. 1996.
2. Agarwal, H.O. Implementation of Human Rights Conventions with special reference to India. Allahabad, Kitab Mahal.1983.
3. Borgohain and Bani: Social Justice and Political change, Kanishka publishers. 1999.

Books for References:

4. Jayapalan. N. Human Rights, Atlantic publishers, New Delhi. 2000.
5. Nirmal. C.J. Human rights in India, Oxford Press. New Delhi.1999.

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|--|-----------------------|---------------|
| Course: B.Sc., Biotechnology(S.F) | Code No | : SMBL21 |
| Semester: 2 | No. of Hrs allotted : | 120 |
| Paper: Core Practical -1 | No. of Credits | : 8 |
| Title of the Paper: -(for SMB11,SMB12,SMB21 & SMB22) | Marks: | 40 + 60 = 100 |

SMB 11 -General Microbiology –Lab Course - Contact hours/week: 2

1. Preparation of culture media
2. Isolation of microbes from soil and drinking water.
3. Pure culture techniques: Pour, Spread, Streak
4. Micrometry
5. Observation of motility of Bacteria – Hanging drop method
6. Bacterial Staining methods: a) Simple staining b) Negative c) Acid fast d) Gram's e) spore f) capsule.
7. Fungal slide culture
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.

SMB 12 - Immunology: -LabCourse - Contact hours/week: 2

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 – Blood grouping and Rh typing
9. Diffusion techniques;-single immuno diffusion
10. Double immuno diffusion

Basics of computers and Bio-informatics –Lab course - Contact hours/week: 2

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. Maths functions: sum, max, min, average. Creating a chart using database. ower point – simple presentation – sound effect – animation. 4. Bioinformatics-Retrieval of databases. Searching: sequences, sequence analysis – protein, DNA (FASTA), BLAST P, BLASTn.

Marine Biotechnology –Lab course - Contact hours/week: 2

1. Study of external morphology and micro preparations of the marine seaweeds: *Ulva*, *Caulerpa*, *Sargassum*, *Turbinaria*, *Padina* and *Gracilaria*
2. Laboratory cultivation of marine cyanobacterium.
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 (S.F)
Semester: 3
Paper: Core 5
Title of the Paper: **MOLECULAR BIOLOGY**

Code No : SMB31
No. of Hrs allotted: 75
No. of Credits : 4
Marks: 25 + 75 = 100

Course Objective:

To appreciate the life process at the molecular level.

To understand the regulatory mechanisms in the flow of genetic information.

Unit :I

Molecular basis of life, principle, scope and application. Bacterial chromosome - circular, nicked, super coiled & covalently closed circular DNA – DNA properties – DNA denaturation & renaturation kinetics - melting curve. Hyperchromicity, cot value.

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, ox model and Okazaki fragments.

Unit: IV

Mechanism of transcriptions: Transcription cycle in prokaryotes and Eucaryotes. 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 Eucaryotes– Post transcriptional and post translational modifications.Hormonal regulations.

Text Books:

1. Freifelder, D. 1990. Molecular Biology, 2nd edition. Narosa Publishing House, New Delhi.
2. Turner, P. C. 2001. Plant Molecular Biology, 2nd edition. Bios scientific publishers, Oxford
3. DeRobertis, E.D.P. and DeRobertis, E.M.F. 2006. Essentials of Cell and Molecular Biology. Holt Saunders Publication, Philadelphia..
4. Lee, P. J. 1999. Plant Biochemistry and Molecular Biology, 2nd edition. John Wiley and Sons, New York.

Reference Books:

1. James Watson, D. 2004. Molecular Biology of Gene, 5th edition. Pearson education publication, Singapore.
2. Benjamin Lewin. 2008. Gene IX. Oxford university press, Oxford.

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| | | |
|--|----------------------|---------------|
| Course: B.Sc., Biotechnology (S.F) | Code No | :SMBE1 |
| Semester: 3 | No. of Hrs allotted: | 75 |
| Paper: Elective paper-1 | No. of Credits | : 3 |
| Title of the Paper: INFECTIOUS DISEASES | Marks: | 25 + 75 = 100 |

Course Objective:

To create an awareness among the students about the human and plant diseases.

UNIT – 1

Symptoms, Epidemiology, Diagnosis, Prevention and Control of the following Human diseases:-
Influenza, Rabies, HIV. Tuberculosis, Leprosy and Meningitis.

UNIT – 2

Symptoms, Epidemiology, Diagnosis, Prevention and Control of the following Animal diseases:-
Anthrax, Black water, Scrapie, Rinder pest, Foot and Mouth, Blue tongue.

UNIT – 3

Plant diseases:- Entry of the plant Pathogen, Establishment of Plant pathogens (Enzymes and Toxins). Interaction between host and pathogen (Physical and Biochemical defense)

UNIT – 4

Study of the following Plant diseases: Causal organism, Symptoms, Disease cycle and Control.
Wheat rust, Cotton blight, Bhendi yellow vein mosaic, Brinjal little leaf, Root knot disease of Tomato and Red rust of Tea.

UNIT – 5

Control methods of plant diseases:- Cultural methods , Quarantine method , Biocontrol method, Chemical methods (Insecticides & Fungicides) – Disease resistant Transgenic Plants.

Text Books:

1. Mehrotra , R .S 1980 Plant pathology . Tata Mc Grew Hill Publishing Company Ltd., New Delhi.
2. Pandey, B. P. 1997. Plant pathology. S. Chand & Company, New Delhi.
3. Arora . R. 1998 Microbiology and diseases. Anmol Publications, New Delhi.
4. Sharma , P. D 2004 . Plant pathology. Rastogi publications, Meerut.
5. Ananthanarayan . R and C. K. J. Paniker. 2000 Text book of Microbiology. Orient longman Publishing Company, Hyderabad.

Reference Books :

1. Schaechter, M., N.C. Englberg., B. I. Eisenstein and G. Medoff . 1999. Mechanisms of Microbial diseases, 3rd edition. Lippincott Williams and Wilkins. Philadelphia.

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|---|-------------------------|
| Course: B.Sc., Biotechnology (S.F) | Code No :SMBNE1 |
| Semester: 3 | No. of Hrs allotted: 30 |
| Paper: Non major Elective -1 | No. of Credits : 2 |
| Title of the Paper: VOCATIONAL BIOTECHNOLOGY | Marks: 15 + 35 = 50 |

Course Objectives:

1. To know about the organic farming and their role in the maintenance of soil fertility.
2. To acquire basic knowledge and develop suitable skills involved in microbial protein production and mushroom cultivation.
3. To learn to occupy oneself during leisure time.

Unit 1:

Organic farming technology : Composting methods – Indoor and Berkely method – Vermiculture. Vermicomposting – Vermiwash Preparation of Pancha Kavia and its applications. Advantages of Organic forming.

Unit 2:

Microbial protein production technology: cultivation methods for Algal, Bacterial and Fungal biomass – nutritional value of single cell proteins.

Text Books:

1. Dubey. R. C. 2002. A text book of Biotechnology S. Chand & Co, New Delhi.
2. Casida, L.E. 2001 Industrial Microbiology New age International publication. New Delhi.

Reference Books:

1. Venkataraman, L.V. and E.W. Beaker 1985. Biotechnology and utilization of Algae. The Indian experience. CFTRI Mysore pp 257

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|--|-------------------------|
| Course: B.Sc., Biotechnology (S.F) | Code No :SAB31 |
| Semester: 3 | No. of Hrs allotted: 90 |
| Paper: Allied -1 | No. of Credits : 4 |
| Title of the Paper: ANALYTICAL BIOCHEMISTRY | Marks: 25 + 75 = 100 |

Course Objective:

To make students understand the principles and working mechanisms of most common laboratory instruments.

Unit 1:

PH metry: Principles, Operation method and uses. Buffer solutions for biological investigations. Colorimetry: principles, instrumentation and applications. Spectroscopic techniques: General principles-Visible, ultraviolet and Atomic absorption Spectroscopy (AAS): principles, instrumentation and applications.

Unit 2:

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 3:

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

Unit 4:

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

Unit 5:

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

Text Books:

1. Plummer, D. 1987. 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. Williams, B. L. and K. Wilson. 1983. A Biologist's guide to Principles and Techniques of Practical Biochemistry, Edward Arnold Publishers Ltd., London
2. Wilson, K and J. Walker. 2005. Principles and Techniques of Practical Biochemistry, 5th Edition. Cambridge University press, New York.

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|--|-------------------------|
| Course: B.Sc., Biotechnology (S.F) | Code No : SMB41 |
| Semester: 4 | No. of Hrs allotted: 75 |
| Paper: Core 6 | No. of Credits : 4 |
| Title of the Paper: GENETIC ENGINEERING | Marks: 25 + 75 = 100 |

Course Objective:

- To expose the students to recent development in gene technology.
- To appreciate the advancement in genetic engineering.
- To acquire a basic knowledge about the various methods of gene transfer and manipulation.

Unit I

Principles of genetic engineering , Restriction enzymes – nomenclature , classification , type of endonuclease in genetic engineering. 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: α -complementation. Hybridization - colony & plaque. Marker inactivation – insertional activation – 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:

1. Primrose, S.B. and R.M. Twyman, 2007. Principles of Genome Analysis and genomics, Blackwell publishing, USA.
2. Old R. W and S. B. Primrose. 1996. Principles of gene manipulations, Black well Science Publications, London.
3. Sandya Mitra, 1998. Genetic engineering, Mac India ltd., New Delhi.
4. Watson, J. D., N. H. Hopkins, J.W. Roberts, J.A. Steitz and A .M . Weiner, 1998. Molecular Biology of the gene, fourth edition, The Benjamin / Cummings Publishing Company Inc., Tokyo.

Reference Books:

1. Brown. T. A., 2000. gene cloning, Fourth edition, Chapman and Hall Publication, USA.
2. Lewin B., 2008. Genes IX, Oxford University Press, Oxford, U.K.
3. 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 (S.F) | Code No | : SMBE2 |
| Semester: 4 | No. of Hrs allotted: | 75 |
| Paper: Elective -2 | No. of Credits | : 3 |
| Title of the Paper: GENOMICS | Marks: | 25 + 75 = 100 |

Course Objective:

1. To have basic knowledge on Genomics.
2. To study the tools for genome analysis.
3. To know about different types of genome projects.
4. To have a basic idea on computational analysis of genome.

Unit I

Introduction to Genomics – Structure and organization of prokaryotic and eukaryotic genomes – nuclear mitochondrial and chloroplast genomes – interaction between nuclear and chloroplast genome – Recognition of coding and non-coding regions and annotation of genes.

Unit II

Tools for genome analysis – rDNA, cDNA, Genomic library, Blotting techniques: Southern, Western, Northern. DNA fingerprinting, PCR and Automated DNA sequencing. Linkage and pedigree analysis – Physical and genetic mapping.

Unit III

Structural genomics; Genome mapping projects and microbes, plants and animals – viral genome - comparative genomics of Prokaryotes and Eukaryotes – Taxonomic classification of organisms RAPD, RFLP techniques and molecular markers – 16 s rRNA typing.

Unit IV

Gene sequence analysis – similarity searchers and pair wise alignment – global and local alignment – multiple sequence alignment – Micro array – cDNA, Oligo nucleotide Microarray.

Unit V

Functional genomics: Gene prediction methods; Neural networks, pattern discrimination methods, signal site prediction - promoter, transcription and translation site prediction, splice signals, CpG-islands

Text Book:

1. Cantor. C and C.W. Smith, 2000, Genomics: The Science and Technology Behind the Human Genome Project, Wiley – Interscience, New York.
2. Arthur M Lesk, 2008. Introduction to genomics. Oxford University Press, Oxford.
3. Primrose, S.B. and R.M. Twyman, 2007. Principles of Genome Analysis and genomics, Blackwell publishing, USA.

Reference Books:

1. Davies. J.M. 1995. Genome Analysis – A Practical Approach, Oxford University Press. Oxford.
2. Dear. P.H. 1997. Genome Mapping _ A Practical Approach, Oxford University Press, Oxford.
3. Schena. M, 1999. Microarrays: A Practical Approach, Oxford University Press, Oxford.

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|---|-----------------------|--------------|
| Course: B.Sc., Biotechnology (S.F) | Code No | : SMBNE2 |
| Semester: 4 | No. of Hrs allotted : | 75 |
| Paper: Non major Elective -2 | No. of Credits | : 2 |
| Title of the Paper: FOOD PROCESSING TECHNOLOGY | Marks: | 15 + 35 = 50 |

Course Objectives:

1. To acquire basic knowledge & develop suitable skills involved in microbial protein production.
2. To have training in food processing technology.
3. To learn to occupy oneself during leisure time.

Unit 1:

Mushroom technology: spawn preparation and cultivation methods of *Agaricus* sp Nutritional and Medicinal value of mushrooms.

Unit 2:

Vegetable and fruit processing technology Preparation of jam, jelly squash and pickle.

Preservation: low temperature, high temperature chemical preservations Milk products: Cheese production technology.

Text book:

1. Casida, L. E. 2001. Industrials Microbiology. New age International publication. New Delhi.
2. Frazier, P.C and P.C. Weathoft ..1988. Food Microbiology. Compass Ltd, New Delhi.
3. Nita Bahl. 199. Hand Book of Mushroom. Oxford & IBH Co Ltd, New Delhi.

Reference Books:

1. Kapoor, J.N.1989. Mushroom cultivation ICAR. New Delhi.
2. Banwari George, J. 1998. Basic food microbiology, 2nd Edition. CBS publishers and distributors, New Delhi.

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Course: B.Sc., Biotechnology (S.F)
Semester: 4
Paper: Core Practical -2
Title of the Paper: -(for SMB31 & SMB41)

Code No : SMBL41
No. of Hrs allotted: 60
No. of Credits : 4
Marks: 40 + 60 = 100

SMB 31 -Molecular Biology –Lab course - Contact hours/week: 2

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. Transfromation experiments in *E.coli*
6. Separation of protein by Polyacrylamide gel electrophoresis
7. Replica plating
8. Demonstration of Conjugation
9. Screening of Lactose utilizers
10. Gradient plate technique

SMB 42 - Genetic Engineering –Lab course - Contact hours/week: 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)
5. Restriction digestion
6. Ligation process
7. Southern blotting of DNA
8. Northern blotting of RNA

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Course: B.Sc., Biotechnology (S.F)

Code No : SAB41

Semester: 4

No. of Hrs allotted: 90

Paper: Allied -2

No. of Credits: 4

Title of the Paper: **BIOMOLECULES**

Marks: 25 + 75 = 100

Course Objective:

To learn various concepts involved in Atomic theories.

To understand the molecular architecture of biomolecules.

To learn the various concepts involved in the mechanism of enzyme action.

Unit: 1

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:2

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

Unit:3

Bonds involved in protein configuration: ionic, hydrophobic, hydrogen, di-sulphide bonds – Types of protein: Globular and fibrous proteins. Enzymes: Classification and nomenclature — Mechanism of enzyme action – Michaelis Menten constant.

Unit 4:

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: RNA, tRNA, rRNA, and hnRNA.

Unit 5:

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

Text Books:

1. Zubay, G. 1993. Biochemistry, third edition. W. H. Freeman publishers, London.
2. Conn. E. E., P. K. Stumpf, G. Bruening and R.H. Doi, 1997. Out line biochemistry, John Wiley & sons Inc., New York.
3. McKee and J.R. McKee, 1996. Biochemistry and introduction. W. H. Freeman publishers, London.
4. S.R. Mishra. 2003. Biomolecules. Discovery publishing house. 360 pp

Reference Books:

1. Stryer, L. 2000. Biochemistry, Fourth edition .W.H. Freeman and company, New York.
2. Voet, and J. G. Voet, 1995. Biochemistry, Second edition. John Wiley & Sons Inc, New York.
3. Nelson, D. L. and M. M . Cox, 2002. Lehninger Principles of biochemistry, third edition. Worth publishers, New York.

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|--|----------------------|---------------|
| Course: B.Sc., Biotechnology (S.F) | Code No | : SMBL41 |
| Semester: 4 | No. of Hrs allotted: | 30 |
| Paper: Allied Practical -1 | No. of Credits | : 2 |
| Title of the Paper: –(for SAB31 & SAB41) | Marks: | 40 + 60 = 100 |

SAB 31 - Analytical Biochemistry –Lab Course - Contact hours/week: 2

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 sugar by TLC
6. Isolation and quantification of proteins(Lowry method)
7. Demonstration of SDS PAGE
8. Demonstration of Agarose electrophoresis
9. Electrophoresis of RNA
10. Demonstration of dialysis.

SAB 41 - Structure and functions of Bio-molecules –Lab Course - Contact hours/week: 2

1. Measurement of pKa value of acetic acid
2. Quantitative estimation of soluble sugars by Phenol sulphuric acid method
3. Quantitative Estimation of Protein by Lowry's Method
4. Quantitative estimation of DNA
5. Quantitative estimation of RNA
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 (S.F) Code No : SMB51
Semester: 5 No. of Hrs allotted: 120
Paper: Core 7 No. of Credits : 5
Title of the Paper: **PLANT BIOTECHNOLOGY** Marks: 25 + 75 = 100

Course Objective:

- To familiarize the students with the basic principles and techniques in tissue culture.
- To orient student learning towards application and career options in the field of biofertilizers.
- To impart knowledge on safe handling and maintenance of transgenic plants and products.

Unit: I

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

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.

Unit:III .

Bio-pharming – Plantibodies, Plantigens. Gene transfer mechanisms – Microinjection, Electroporation and Biolistics. Transgenic plant as bioreactors.

Unit: IV

Agrobacterium mediated gene transfer - Transgenic plants – crop improvement, resistance to herbicide, cytoplasmic male sterility – delayed fruit ripening, edible vaccines, interferon production in plants.

Unit:V

Cloning for the production of edible vaccine and interferon. Stress tolerant plants – insect resistance – virus resistance – disease resistance. Future prospects for GM Crops – Bt crops –Bt Brinjal.

Text Books:

1. Old, R. W. and S. B. Primrose. 2000. Principles of gene manipulation. An introduction to genetic engineering, 5th edition. Blackwell Science Ltd., Oxford
2. Winnacker, E. N. 2003. From genes to clones. Panama publishing corporation Pvt., Ltd., New Delhi..
3. Kannaiyaan, S. 2002 Biotechnology of Biofertilizers. Narosa publishing house, New Delhi.
4. Subha Rao, N. S. 2003. Soil Microbiology 4th edition. Oxford & IBH Publishing Co, Pvt Ltd, New Delhi.

Reference Books:

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

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| | | |
|---|----------------------|---------------|
| Course: B.Sc., Biotechnology (S.F) | Code No | : SMB52 |
| Semester: 5 | No. of Hrs allotted: | 135 |
| Paper: Core 8 | No. of Credits | : 5 |
| Title of the Paper: INDUSTRIAL BIOTECHNOLOGY | Marks: | 25 + 75 = 100 |

Course Objective:

To understand the principles and strategies involved in using biological systems for technological applications.

To 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, D.S.P. of different products.

Unit III

Fermentors or Bioreactors – Principles of chemostat and turbidostat – designs of Batch, Continuous stirrer type fermentor, Tower, Fluidized bed fermentors – operation and control . Industrial alcohol production – gasohol – fermentation of wine and beer

Unit IV

Amino acid fermentation (L – Glutamic acid and L- Lysine). Fermentation of antibiotics [Penicillin & Streptomycin] – organic acids [Citric acid, Lactic acid, Vinegar & Kojic acid] - Vitamins [Riboflavin & Cyanocobalamine] and steroids.

Unit V

Enzyme biotechnology – Principles – Industrial enzyme production methods: tray and deep bed cultivation– enzyme recovery and purification – methods of enzyme immobilization. Production of α – amylase, protease and cellulase- application of industrial enzymes.

Text Books:

1. Casida, L.E. Jr. 2001. Industrial Microbiology. New age International Publishers, New Delhi.
2. Patel, A.H. 2004. Industrial Microbiology. Macmillan India Ltd, Delhi.
3. Crueger, W. and A. Crueger. 2000. Biotechnology: A Textbook of Industrial Microbiology. Panima publishing corporation, New Delhi.
4. Reed, G. 1987. Prescott and Dunn's Industrial Microbiology. CBS publishers and Distributors, New Delhi.

Reference Books:

1. Stanbery, P.F., A. Whitaker. and S.J. Hall. 2009. Principles of Fermentation Technology. Aditya Books (P) Ltd, New Delhi.

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Course: B.Sc., Biotechnology (S.F) Code No : SMBE3
Semester: 5 No. of Hrs allotted: 75
Paper: Elective-3 No. of Credits : 3
Title of the Paper: **PROTEOMICS** Marks: 25 + 75 = 100

Course Objectives:

1. To have a basic knowledge in proteomics
2. To create awareness on proteomic tools used for protein analysis
3. To acquire basic idea on pharmacogenetics.
4. To understand the utility of Bioinformatics tools in Proteomics.

Unit 1:

Introduction to Proteomics – Genome – Transcriptome – Proteome - Metabolome – Interactome – Applications of Proteomics.

Unit 2:

Characterization of protein complexes : Protein – Protein interactions – Amino and carboxy terminal sequence analysis – hybrid protein Analysis. Peptide mapping and sequence analysis of gel-resolved proteins. Proteomic methods for polysome site mapping.

Unit 3:

Pharmacogenetics: high throughput screening for drug discovery – identification of drug targets – Pharmacophore – Pharmacogenetics and drug development, ADME properties – Metabolome and Metabolomics.

Unit 4:

Proteomic Tools – Identification and analysis of protein by 2D PAGE analysis – Mass spectrophotometry, MALDI-TOF, NMR, CD, FTIR, Differential display proteomics.

Unit 5:

Protein micro arrays: Basic principles protein engineering : Protein structure determination – Antisense technology. Prediction of protein structure and function in bioinformatics.

Text books:

1. Wilkins. M. R., K. L. Wilkins., R.D. Appel and Hochstrasser, 1997.
proteome Research and New Frontiers in Functional Genomics Spring – Velag New york,.
2. Walsh G and Haeden, 1994 protein Biotechnology, John Wiley and sons.

Reference Books.

1. Vestermeier, R and T Naven. 2002. Proteomics in practice: a laboratory manual of genome analysis . Wiley – VCH, Weinheim ISBN 357303545.
2. Liebler, C. C. 2002 Introduction to proteomics : Tools for the new biology
Human, press, Totowa, NJ. ISBN 0585418799
3. Link A.L., 1998 2-D Proteome Analysis Protocols, Human press, Totowa, NJ.
4. Reviews and Articles . Journal such as Nature, science. PNAS (USA) Nucleic Acids Research, Trends Series & Current Opinion /series.
5. Simpson, R.J., 2003 Proteins & Proteomics: A laboratory manual. I. k. International Pvt, Ltd. New Delhi.

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|---|-------------------------|
| Course: B.Sc., Biotechnology (S.F) | Code No : SMBSE5 |
| Semester: 5 | No. of Hrs allotted: 30 |
| Paper: Skill based Elective-5 | No. of Credits : 2 |
| Title of the Paper: BASICS OF METABOLIC PATHWAYS | Marks: 15 + 35 = 50 |

Course Objectives:

To understand the types of metabolic pathways and the role of common intermediate compounds.

To learn the biosynthesis and breakdown of biomolecules.

Unit I

Introduction – Types of metabolic pathways: Catabolic, anabolic, cyclic, anapluerotic, amphibolic pathways. Bioenergetics: Laws of thermodynamics – Redox reactions- Redox potential – coupled reactions – High energy compounds: Standard free energy –ATP biosynthesis. Metabolism of carbohydrates: Glycogen metabolism – Interrelationship between pathways of glucose metabolism.

Unit II

Metabolism of lipids: Biosynthesis of fatty acids and cholesterol. α – and β – oxidation of fatty acids. Metabolism of protein: Reductive amination and transamination – glutamate pathway – Translation. Protein degradation – oxidative deamination – Urea cycle. Secondary metabolism in microbes: Relationship between primary and secondary metabolism - Shikimic acid pathway.

Text Book:

1. Lehninger, A.L. 2005. Biochemistry V edition, Kalyani Publishers, Ludhiana.
2. Zubay, G.L., Pason, W.W. and Vane, D.E. 1995. Principles of Biochemistry W.W.C Brown Publishers , Oxford.

Reference Books:

1. Stryer, L. 1995. Biochemistry, Fourth edition. W.H. Free Man & Company New York.
2. Voet , D. and Voet, J.D. 1990. Biochemistry. John Wily & Sons, New York.

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Course: B.Sc., Biotechnology (S.F)
Semester: V
Paper: Self study
Title of the Paper: **BOTANICAL WORLD**

Code No :
No. of Hrs allotted:
No. of Credits : 2
Marks: 15 + 35 = 50

Objective :

- To acquire the basic knowledge of plants.
- To understand the role of plants in day-to-day life.

UNIT I

Wonder Plants : Tree fern, Tallest tree (*Sequoia*), century plant (*Agave*), Bamboo, biggest flower (*Rafflesia arnoldii*),

Largest leaf (*Victoria regia*), Neelakurinji flower (*Strobilanthes kunthianus*), Sensitive plant (*Mimosa pudica*), Orchids, Insectivorous plants.

Plant Animal interaction : Symbiosis, Myrmecophily, lac insect, Pollination mechanism and honey.

UNIT II

Plants of the Past : Fossil fuels. Plants as : Food makers (primary producers), Scavengers (decompositions),

Purifiers (air, water), Industrialists (antibiotics, vaccines, vitamins, beverages, biofertilizers).

Medicine (Tulsi, Pepper, Ginger, Eucalyptus, Kilanelli and Turmeric)

Text Books:

1. G. Brum, L. Mc Kane and G. Karp. 1995. Biology Fundamentals, John Wiley & Sons, Inc., Canada.,
2. D. K. Northington, 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, John Murray.,
2. 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

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|--|----------------------|---------------|
| Course: B.Sc., Biotechnology (S.F) | Code No | : SMBL51 |
| Semester: 5 | No. of Hrs allotted: | 60 |
| Paper: Core Practical -3 | No. of Credits | : 4 |
| Title of the Paper: –(for SMB51 & SMB52) | Marks: | 40 + 60 = 100 |

SMB -51 - PLANT BIOTECHNOLOGY –Lab course - Contact hours/week:4

1. Preparation of tissue culture medium (MS medium).
2. Preparation of explant.
3. Callus induction from the leaf explants of *Datura*.
4. Shoot initiation from *Datura* callus.
5. Root initiation from *in vitro* formed shoots of *Datura*.
6. Hardening and transplanting.
7. Isolation of nitrogen fixing *Rhizobium*, *Azotobactor*, *Azospirillum* and Phosphate solubilizing bacteria from soil.
8. Isolation of secondary metabolites from callus – TLC method..
9. Demonstration of PCR techniques –RAPD analysis in plants.

SMB 52 – INDUSTRIAL BIOTECHNOLOGY –Lab course-Contact hours/week: 4

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 (S.F) | Code No : SAB51 |
| Semester: 5 | No. of Hrs allotted: 90 |
| Paper: Allied-III | No. of Credits : 4 |
| Title of the Paper: CELL BIOLOGY AND PHYSIOLOGY | Marks: 25 + 75 = 100 |

Course Objective:

To understand the basic structure and function of a cell and to appreciate the cell as the basic and fundamental unit of an organism.

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: Ultra structure, chemical nature, origin and functions. Bio-Membrane : structure – fluid mosaic model. Ultra-structure and chemical composition of Mitochondria

UNIT-II

Organelles: 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. Cell cycle: Mitosis and meiosis.

UNIT III

Digestion: Physiology of digestion enzymes involved; liver & pancrease – Excretion: Structure of Kidney and nephron . Brain and its function. Respiration: Respiratory organs – Physiology of respiration. Circulation: Composition of blood - structure of heart – double circulation. (Mammalian circulation) . Neuro-transmitter system; Cell signaling.

UNIT IV

Water potential and its components – Absorption of water: apoplast and symplast concept – active and passive mechanism – Transpiration: Mechanism of opening and closing of stomata (theory of K^+ Transport and hormonal regulation only). Absorption of minerals: Mechanism (Carrier concept Only) – Translocation of organic solutes: Mechanism (electro osmotic theory only)

UNIT V

Cyclic and non-cyclic photo phosphorylation. Carbon fixation: C_3 , C_4 and CAM pathways – Photorespiration. Respiration: Respiratory substrates – RQ – Aerobic respiration – Glycolysis – TCA cycle – Electron transport and oxidative phosphorylation – pentose phosphate pathway.

Text Books:

1. Becker, W.M., Kleinsmith, L.J. and Hardin, J. 2007. The World of the cell, sixth edition, Pearson Education, Inc.
2. Noggle, G .R. and G. J. Fritz. 1986. Introductory Plant Physiology. Prentice Hall of India Pvt. Ltd, New Delhi.
3. Devlin, R.M, and F. H. Witham. 1986. Plant Physiology. CBS publishers and Distributors, New Delhi.
4. Sastry, K.V. 2004. Animal Physiology, first edition. Rastogi Publications, Meerut.
5. Verma, P.S. and B. S. Tyagi. 2002. Animal Physiology, sixth edition. S. Chand & Company, New Delhi.

Reference Books:

1. DeRobertis, E.D.P. and DeRobertis, E.M.F. 2006. Essentials of Cell and Molecular Biology, Saunders College Publishing, Japan.
2. Salisbury, F.B. and C. N. Ross. 2004. Plant Physiology. CBS publishers and Distributors. New Delhi.
3. Kavija Juneja, 2002. Animal Physilogy, first edition. Anmol Publications, New Delhi.

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|---|----------------------|---------------|
| Course: B.Sc., Biotechnology (S.F) | Code No | : SMB61 |
| Semester: 6 | No. of Hrs allotted: | 180 |
| Paper: Core 9 | No. of Credits | : 5 |
| Title of the Paper: ANIMAL BIOTECHNOLOGY | Marks: | 25 + 75 = 100 |

Course Objective:

To understand the mammalian cell culture and transgenic animal technology
To become aware of 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. Application of animal cell culture .

Unit :II

Transfection of mammalian cells: Calcium phosphate mediated co- transfection – microinjection – liposome mediated – electroporation - ultrasonication – – detergent mixture– use of viruses – viral vectors –SV40 and adenovirus – improved strains – basic properties.

Unit :III

Transgenic animal technology: concept of transgene and transgenics- Expression of foreign genes in transgenic mice –production of transgenic sheep for growth hormone genes – Insertion and expression of transgenes – production of transgenic cattle by pronuclear injection – collection, culture and transfer of embryos. Advantages and disadvantages of transgenesis. Transgenic animals as a model for human disease diagnosis.

Unit :IV

Production of biotechnological molecules : Hybridoma technology.Steps involved in production of recombinant pharmaceuticals – recombinant insulin and interferons. Human growth hormone: Somatostatin and Somatotrophin – Blood products.

Unit: V

Pre implanted genetic diagnosis in human beings: Introduction, Methods and applications – IVR technology-embryo transfer technology: Gamete intra fallopian transfer technology (GIFT) and Zygote intra fallopian transfer technology (ZIFT),. (MOET). Stem cell culture. Embryonic stem cells and their applications.

Text Books:

1. Ranga M. M. 2002 Animal biotechnology 2nd edition. Agrobios, Jodhpur
2. Prakash. M, and K. Arora. 1998. Cell & tissue culture 1st Edition, Anamol publication, New Delhi.
3. Jogdand, S. N. 2001. Advances in Biotechnology 3rd edition. Himalaya Publishing House, Mumbai.

Reference Books:

1. Glick, B. R. and J. J. Pasternak. 2003. Moleculer biotechnology. Principles and application of Recombinant DNA; 3rd edition. ASM press Washington D.C

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|--|----------------------|---------------|
| Course: B.Sc., Biotechnology (S.F) | Code No | : SMB62 |
| Semester: 6 | No. of Hrs allotted: | 150 |
| Paper: Core 10 | No. of Credits | : 5 |
| Title of the Paper: ENVIRONMENTAL BIOTECHNOLOGY | Marks: | 25 + 75 = 100 |

Course Objective:

- To enable the students to know about environmental biotechnology.
- To impart knowledge on waste disposal and bioleaching.
- To introduce the concept of bioremediation.

Unit :I

Introduction to environmental biotechnology – issues for environmental biotechnology – scope for environmental biotechnology – role of biotechnology in environmental protection.

Unit :II

Domestic sewage treatment –Oxidation pond - trickling filter - reverse Osmosis. Activated sludge process - aerated lagoons. Industrial effluent treatment: Treatment of waste from dairy, poultry, meat products, canning, breweries, paper, tannery, dye industries and radioactive product wastes.

Unit :III

Biogas- construction of biogas plant – composting – biogas slurry – use of compost in organic farming – Coir pit compost. Biofuel : biodiesel – bioconversion of cellulose to ethanol – Hydrogen production from microbes and sea weeds.

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 . Xenobiotics : Microbial degradation of xenobiotics – Manipulation by transfer of plasmids and gene alteration - biodegradation of pesticides and other toxic chemicals.

Text books:

1. Subha rao, N.S. 2001. Soil microbiology. Raju primlani Publishing Pvt. Ltd., New Delhi.
2. Dash, M.C. 2001. Fundamentals of ecology, 2nd edition, Tata McGraw Hill Publishing company Ltd., New Delhi.
3. Alexander Glazer, N. 2001. Microbial biotechnology, Third reprint. W.H. Freeman & Company, New York.
4. Dubey, R.C. 2001. A text book of microbiology, second reprint. S. Chand and Company Ltd., New Delhi.
5. Pradipta Kumar Mohapatra, 2006. Text book of environmental biotechnology, I.K. International publishing house, New Delhi.
6. Jogdand, S.N. 2006. Environmental Biotechnology, Third edition, Himalaya publishing house, Mumbai.

Reference Books:

1. Jogdand, S. N.2004. Environmental biotechnology. Himalaya Publishing House, Mumbai.
2. Markandy, D.K and N. Rajvaidys. 2004. Environmental Biotechnology. APH Publishing Corporation, New Delhi.

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Course: B.Sc., Biotechnology (S.F) Code No : SMBSE6
Semester: 6 No. of Hrs allotted: 30
Paper: Skill based Elective-6 No. of Credits : 2
Title of the Paper: **BIOSAFETY AND INTELLECTUAL PROPERTY RIGHTS**

Marks: 15 + 35 = 50

Course Objectives:

- To be motivated and have a sense of responsibility towards Biosafety.
- To understand and have a basic knowledge of Patenting
- To make them aware of the avenues for self-employment
- To develop skills in entrepreneurship among the students.

Unit I:

World Trade Organization (WTO) – General Agreement on Tariffs and Trade (GATT) & Trade and Intellectual Property Rights (TRIPs). Different types of intellectual property rights. Convention on International Trade on Endangered species (CITES). Role of Non-government in different countries. Patent application- Rules governing Patents.

Unit II:

Biosafety-general guide lines-guide lines for rDNA research activity- Containment facilities and Bio safety practices-guidelines for research in genetically manipulated microbial strains: Genetically Modified Organisms (GMO'S) and Genetically Manipulated Strains (GEMS), Bio safety in releasing Transgenic Animals and plants. Government strategies in r DNA technology and human gene cloning

Text Books:

1. Brown. T.A., 2000. Gene cloning, Fourth edition. Chapman & Hall Publication, New York.
2. Casida, L.E. Jr. 2001. Industrial Microbiology. New age International Publishers, New Delhi.
3. Dubey, R.C. 2002. a Text book of Biotechnology .S. Chand & Co, New Delhi.
4. Jogdand., S. N 2001. Advances in Biotechnology 3rd edition; Himalaya Publishing House, Mumbai.
5. Old, R. W. and S. B. Primrose. 1994. Principles of gene manipulation. An introduction to genetic engineering, 5th edition. Blackwell Science Ltd.,
6. Patel, A.H. 1984. Industrial Microbiology. Macmillan India Ltd, Delhi.

Reference book:

1. Glick, B.R. and J.J. Pasternak. 2003. Molecular biotechnology. Principles and application of Recombinant DNA , 3rd edition. ASM press, Washington D.C.

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Course: B.Sc., Biotechnology (S.F)
Semester: 6
Paper: Core Practical -4
Title of the Paper: for SMB61 & SMB62

Code No : SMBL61
No. of Hrs allotted: 180
No. of Credits : 4
Marks: 40 + 60 = 100

SMB 61 - ANIMAL BIOTECHNOLOGY –Lab course–Lab course - Contact hours/week: 6

1. Blood grouping.
2. Haemagglutination – Immunelectrophoresis
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.

SMB 62 -ENVIRONMENTAL BIOTECHNOLOGY –Lab course–Lab course - Contact hours/week: 6

1. Physico -chemical characterization of effluents – colour, pH, Temp. COD & BOD.
2. Biological treatment of oil spilled effluent.
3. Biological treatment 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 compost.
9. Extraction of Biodiesel.
10. Demonstration of bioconversion of cellulose to ethanol.

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| | |
|---|-------------------------|
| Course: B.Sc., Biotechnology (S.F) | Code No : SAB61 |
| Semester: 6 | No. of Hrs allotted: 90 |
| Paper: Allied-4 | No. of Credits : 4 |
| Title of the Paper: GENETICS AND EVOLUTION | Marks: 25 + 75 = 100 |

Course Objective:

- To acquire a firm foundation in the field of Genetics
- To understand and apply the various concepts involved in Genetics
- To acquire knowledge about the basic principles of heredity.
- To have a clear-cut picture about the various statistical principles that can be used in their higher studies

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, 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. 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.

Unit: V

Origin of earth, Origin of life, various theories on origin of life, theories on evolution- use and disuse, survival of fittest. Various eras, Evolution in Man.

Text Books:

1. Sarin, C.1989. Genetics. Tata McGraw- Hill Publishing company Ltd. New Delhi.
2. Palanichamy, S. and M. Manoharan. 1994. Statistical Methods for Biologists. Palani Paramount Publications, Palani.
3. Gupta, S. P. 1977. Statistical methods, 9th edition. S. Chand & Sons Publishers, New Delhi.

Reference Books:

1. Strickberger, M.W., 1985. Genetics, 3rd Ed., MacMillan Publishing, New York.
2. Gardner, E.J. and J. Michael Simmons. 2003. Principle of genetics 8th edition, John Wiley & Sons, New York.
3. Burton Guttsnan. 2011. Genetics: The code of Life. Prentice Hall. 293 pp

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| | |
|---------------------------------------|-------------------------|
| Course: B.Sc., Biotechnology (S.F) | Code No : SABL61 |
| Semester: 6 | No. of Hrs allotted: 60 |
| Paper: Allied Practical -4 | No. of Credits : 2 |
| Title of the Paper: for SAB51 & SAB61 | Marks: 40 + 60 = 100 |

SABL 61 – Allied Practical Paper II (for SAB51 & SAB61)

SAB 51 - CELL BIOLOGY & PHYSIOLOGY –Lab course - Contact hours/week: 2

1. Blood smear preparation: observation of different cells
2. Estimation of blood sugar
3. Demonstration of salivary amylase activity
4. Observation of Haemin crystals.
5. Determination of stomatal index
6. Determination of water potential of potato using falling drop method.
7. Determination of Osmotic potential of cell sap using plasmolysis method.
8. Study of Mitosis in onion root squash
9. Study of Non living inclusions: Starch grain of potato tuber, rice and banana.
Cystolith of *Ficus* – raphide of *Acalypha*, Crystals of dry onion peel
10. Haemocytometer – to calculate total no. of cells
11. Micrometry – to measure dimension of cell

SAB 61 - Genetics and Evolution –Lab Course - Contact hours/week: 2

1. Problems in Monohybrid
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.

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DEPARTMENT OF BOTANY
MASTER OF SCIENCE IN BIORESOURCES MANAGEMENT
COURSE STRUCTURE (w.e.f 2011-12 batch onwards)

| CODE No. | SUBJECT | CONTACT Hrs/Week | CREDITS | Total No. of Hrs Allotted | MAX. MARKS CA | MAX. MARKS SE | TOTAL MARKS |
|----------|---|------------------|---------|---------------------------|---------------|---------------|-------------|
| 1PR1 | Introduction to Bioresources | 5 | 5 | 75 | 25 | 75 | 100 |
| 1PR2 | Molecular tools in Bioresources | 5 | 5 | 75 | 25 | 75 | 100 |
| 1PRL1 | Lab for 1PR1 | 8 | 4 | 120 | 40 | 60 | 100 |
| 1PRL2 | Lab for 1PR2 | 7 | 4 | 105 | 40 | 60 | 100 |
| 1PRE1 | Elective 1: Biostatistics/ Nanotechnology | 5 | 5 | 75 | 25 | 75 | 100 |
| | Total: | 30 | 23 | 450 | 155 | 345 | 500 |

Semester - II

| CODE No. | SUBJECT | CONTACT Hrs/Week | CREDITS | Total No. of Hrs Allotted | MAX. MARKS CA | MAX. MARKS SE | TOTAL MARKS |
|----------|---|------------------|---------|---------------------------|---------------|---------------|-------------|
| 2PR1 | Microbial Diversity and Utilization | 5 | 5 | 75 | 25 | 75 | 100 |
| 2PR2 | C – Programming | 5 | 5 | 75 | 25 | 75 | 100 |
| 2PRL1 | Lab for 2PR1 | 8 | 4 | 120 | 40 | 60 | 100 |
| 2PRL2 | Lab for 2PR2 | 7 | 4 | 105 | 40 | 60 | 100 |
| 2PRE1 | Elective 2: Biodiv.& Conser./Environ. & Conser. Biology | 5 | 4 | 75 | 25 | 75 | 100 |
| | Total: | 30 | 22 | 450 | 155 | 345 | 500 |

Semester -III

| CODE No. | SUBJECT | CONTACT Hrs/Week | CREDITS | Total No. of Hrs Allotted | MAX. MARKS CA | MAX. MARKS SE | TOTAL MARKS |
|----------|--|------------------|---------|---------------------------|---------------|---------------|-------------|
| 3PR1 | Forest resources and Management | 6 | 5 | 90 | 25 | 75 | 100 |
| 3PR2 | Marine resources and Management | 6 | 5 | 90 | 25 | 75 | 100 |
| 3PRL1 | Lab for 3PR1 | 8 | 5 | 120 | 40 | 60 | 100 |
| 3PRL2 | Lab for 3PR2 | 8 | 5 | 120 | 40 | 60 | 100 |
| 3PRE1 | Non-major Elective : Bioresources Modelling & Remote sensing | 2 | 2 | 30 | 15 | 35 | 50 |
| | Total: | 30 | 22 | 450 | 145 | 305 | 450 |

| Semester -IV | | | | | | | |
|--------------|---|------------------|---------|---------------------------|---------------|---------------|-------------|
| CODE No. | SUBJECT | CONTACT Hrs/Week | CREDITS | Total No. of Hrs Allotted | MAX. MARKS CA | MAX. MARKS SE | TOTAL MARKS |
| 4PR1 | Bioinformatics and Bioresources Engineering | 5 | 5 | 75 | 25 | 75 | 100 |
| 4PR2 | Internet and Java Programming | 5 | 5 | 75 | 25 | 75 | 100 |
| 4PRL1 | Lab for 4PR1 | 8 | 4 | 120 | 40 | 60 | 100 |
| 4PRL2 | Lab for 4PR2 | 7 | 4 | 105 | 40 | 60 | 100 |
| 4PRE1 | Elective 3: Project | 5 | 5 | 75 | 40 | 60 | 100 |
| | Total | 30 | 23 | 450 | 155 | 345 | 500 |

Theory: Internal: 25 Marks [Assignment 5 marks; Seminar 15 marks; Test 30 marks (duration 2 hrs).

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 20 = 100

A) Consolidation of Contact Hours and Credits: PG -BRM

| Semester | Contact Hrs / Week | Credits |
|----------|--------------------|---------|
| I | 30 | 23 |
| II | 30 | 22 |
| III | 30 | 22 |
| IV | 30 | 23 |
| Total | 120 | 90 |

B) Curriculum Credits

Core74 –Credits
Major Elective14 -Credits
NME.....02 - Credits

Total -----
90 Credits

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| | | |
|---|----------------------|---------------|
| Course: M.Sc., Bioresources Management | Code No | : 1PR1 |
| Semester: 1 | No. of Hrs allotted: | 75 |
| Paper: Core | No. of Credits | : 5 |
| Title of the Paper: INTRODUCTION TO BIORESOURCES | Marks: | 25 + 75 = 100 |

Course Objective:

To create awareness on the origin, evolution, classification, distribution, community organization and resource base of plants and animals

Unit 1: Nomenclature: Terms and definitions - Binomial nomenclature - citation of Authors' name - ICBN - Historical background of classification: Natural systems, phylogenetic and modern systems (Outline only). Modern trends in taxonomy: numerical taxonomy, chemotaxonomy, molecular taxonomy, computerized systematics

Unit 2: Origin of life - theories of evolution – Lamarckism, Darwinism, Mutation theory, modern synthetic theory - types of evolution and evolution in action - Speciation – types and mechanism of speciation – adaptation, polymorphism and co-evolution

Unit 3: Biogeography: Phytogeographical regions of the world, faunal realms, island biogeography theory, continental drift, continuous and discontinuous distribution, endemic distribution - floristic regions.

Unit 4: Population biology: Basic concepts – food chain, food web, niche concept, Gause's principle, survivorship curves - self regulating mechanisms. Species interaction - evolution of cooperation, inter-specific competition, competition coexistence, Negative interaction: predation, herbivory, parasitism - Positive interaction - commensalisms and mutualism.

Unit 5: Bioresources (with special reference to India): Introduction - forest resources, wild life resources, agricultural resources, live stock, marine resources, freshwater resources, mangroves, insect produces – lac, silk and honey

Text Books:

1. Ananthakrishnan, T.N. 1987. Bioresources ecology. Oxford and IBH Publishing Company and Pvt. Ltd., New Delhi.
2. Henry, A.N. and Chandrabose, M. 1980. An aid to the International code of botanical nomenclature. Today and tomorrow printer and publishers, New Delhi.
3. Michael, P. 1987. Ecological methods for field and laboratory investigations. Tata McGraw Hill Publishing Co., New Delhi.
4. Odum, E.P. 1996. Fundamentals of Ecology. III edn. Nataraj Publishers, Dehradun .
5. Sambamurty, A.V.S.S. 2005. Taxonomy of angiosperms. IK International Pvt. Ltd., New Delhi.
6. Stiling, P. 2002. Ecology - Theories and applications. Printice-Hall of India. Pvt. Ltd. New Delhi.

Books for Reference:

1. Tivy, J. 1982. Biogeography - A study of plants in the ecosphere. Longman, London.
2. Dodds, W.K. 2006. Freshwater Ecology- Concepts and Environmental applications. Academic press. USA.
3. Gurevitch, J. Scheiner, S.M. and Fox, G.A. 2002. The Ecology of Plants. Sinauer associates, inc., Publishers. Massachusetts.

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DEPARTMENT OF BOTANY
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Course: M.Sc., Bioresources Management

Semester: 1

Paper: Core

Title of the Paper: **MOLECULAR TOOLS IN BIORESOURCES**

Code No : 1PR2

No. of Hrs allotted: 75

No. of Credits : 5

Marks: 25 + 75 = 100

Course Objective:

To provide basic knowledge on the organization, functioning, sequencing of genome and its application on Bioresources management

Unit 1: Gene: Gene concept - Genome structure and architecture in prokaryotes and eukaryotes - mitochondria and chloroplast gene organization -: DNA Polymorphism. RNA - composition and types RNA. DNA damage – types, DNA repair –Photo reactivation, Nucleotide Excision Repair, Mismatch repair and SOS repair.

Unit 2: DNA Technology: Gene cloning - strategies - Cloning vectors - plasmids, cosmids, phage, expression vectors and shuttle vectors. Mechanism of transformation. - PEG mediated - microinjection - particle bombardment - electrophoration, Ti plasmid Construction of cDNA libraries and genome libraries

Unit 3: Detection of cloned genes - preparation of molecular probes - genomic DNA, cDNA, synthetic oligonucleotide, Riboprobes. Colony hybridization, Autoradiography, Southern blotting and Northern blotting.

Gene mapping - Conjugation and Restriction mapping, DNA foot printing. Chromosome walking
Chromosome jumping

Unit 4: Genome mapping: Physical mapping - markers - RFLP - RAPD - VNTRs - SNPs -
Microsatellites - Minisatellites - Fluorescent *in situ* Hybridization (FISH) Gene sequencing:
Maxam and Gilbert method, Sangar - Coulsen's method - Messing's method.

Unit 5: Detection of cloned products: Expression of cloned genes - Isolation and purification of the expressed products -Protein gel electrophoresis - Western blotting, Immunoblotting.

Biosafety: Biosafety and environment - Biosafety and human health

Text Books:

1. Freifelder, D. 2000. Molecular Biology. II Edn., Narosa Publishing House, New Delhi.
2. Glick, B.K. and Pasternak, J.J. 1994. Molecular Biotechnology Principles and Application of Recombinant DNA. ASM Press, Washington.
3. Lewin, B. 2000. Genes VIII edn., Oxford University Press, New York.
4. Sambrook, J., Fritsch, E.F. and Maniatis, T. 1989. Molecular Cloning - A lab Manual. II edn. CSH Press, Cold Spring Harbour.

Reference Books:

5. Wolfe, S.L. 1993. Molecular and Cellular Biology. Wadsworth Publishing Company, California.
6. Brown, T.A. 1994. DNA sequencing: The basis. Oxford University Press, Oxford.
7. Brown, T.A. 1995. Gene Cloning: An Introduction. III edn. Chapman & Hall, London.
8. Brown, T.A. 1999. Genomes. BIOS Scientific Publishers, Oxford.

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Course: M.Sc., Bioresources Management

Code No : 1PRL1

Semester: 1

No. of Hrs allotted: 120

Paper: Lab for 1PR1

No. of Credits : 4

Title of the Paper: **INTRODUCTION TO BIORESOURCES**

Marks: 40 + 60 = 100

1. Calculation of taxonomic distances based on numerical taxonomy
2. Preparation of data matrix for binary coding of selected families.
3. Chemotaxonomic identification of plants using starch grains and Raphides
4. Classification of organisms based on serotaxonomy
5. Experiment to prove Hardy Weinberg equilibrium
6. Demonstration of Natural selection in species evolution
7. Measurement of population fluctuation
8. Preparation of survivorship
9. Spotters: Type specimen, Molecular Taxonomy, Continuous and discontinuous distribution, Speciation, Polymorphism, Species interaction.
10. Field visit

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| | | |
|--|----------------------|---------------|
| Course: M.Sc., Bioresources Management | Code No | : 1PRL2 |
| Semester: 1 | No. of Hrs allotted: | 105 |
| Paper: Lab for 1PR2 | No. of Credits: | 4 |
| Title of the Paper: MOLECULAR TOOLS IN BIORESOURCES | Marks: | 40 + 60 = 100 |

1. Isolation of Plasmid and Genomic DNA from microbes
2. Isolation of Genomic DNA from animal tissue
3. Quantitative estimation of DNA by Diphenyl amine method
4. Agarose Gel Electrophoresis of bacterial and plasmid DNA
 - a. Cloning of a DNA fragment in a known vector
 - b. Preparation of competent cells
 - c. Recombinant colony screening
 - d. Isolation of recombinant plasmid
 - e. Restriction analysis
5. Demonstration of PCR amplification
6. Isolation of total RNA
7. Colorimetric estimation of RNA
8. Electrophoretic separation of proteins
9. Demonstration of Western blotting
10. Isolation of spontaneous mutants by gradient plate technique
11. Bacterial conjugation

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Course: M.Sc., Bioresources Management

Code No : 1PRE1

Semester: 1

No. of Hrs allotted: 75

Paper: Elective -1

No. of Credits : 5

Title of the Paper: **BIOSTATISTICS**

Marks: 25 + 75 = 100

Course Objective

To apply statistical tools to analyze data on Bioresources

Unit 1: Data collection and interpretation: Types of population - sample – non probability sampling techniques - random sampling techniques - choice of sampling methods-sampling and non sampling errors. Diagrammatic and graphical representation of data; Measures of central tendency: Mean - median - mode. Measures of dispersion: Range - mean deviation - standard deviation

Unit 2: Designs of experiment – Randomized block design, completely randomized block design, Latin square design; Cluster analysis - strategies of clustering, construction of dendrograms, interpreting phylogenetic relationship- merits and demerits

Unit 3: Probability distribution: Binomial distribution - Poisson distribution - normal distribution – t distribution - F distribution - chi square distribution

Unit 4: Test of significance: Null hypothesis - alternate hypothesis - confidence interval - level of significance - p value - S.E of mean - S.E of standard deviation - Z test - t test - chi square test. Non parametric test: Mann Whitney test - Kruskal -Wallis test.

Unit 5: Correlation and Regression: correlation analysis - types of correlation - significance test of correlation coefficient. Linear regression analysis - significance test of regression coefficient ANOVA - one way ANOVA - two way ANOVA

Text Books:

1. Khan, I A. and Khanum, A. 2004. Fundamentals of Biostatistics. Ukaaz Publications. Hyderabad.
2. Rosner, B. 2000. Fundamentals of Biostatistics. V edn. Duxbury, USA.
3. Zar, J.H. 2003. Biostatistical analysis. Pearson education. Singapore.

Books for Reference:

4. Bailey, N.J.J. 1994. Statistical methods in Biology. Cambridge University Press. Cambridge.
5. Forthofer, R.N. and Lee, E.S. 2006. Introduction to Biostatistics. Academic Press. USA.

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| | |
|---|-------------------------|
| Course: M.Sc., Bioresources Management | Code No : 1PRE1 |
| Semester: 1 | No. of Hrs allotted: 75 |
| Paper: Elective -1 | No. of Credits : 5 |
| Title of the Paper: NANOTECHNOLOGY | Marks: 25 + 75 = 100 |

Course Objective

- a. To understand the fundamental concepts
- b. To apply Nanotechnology in various fields of science

Unit 1: Nanotechnology: Definition, origin, scope, overview, health and environmental concerns

Unit 2: Application of nanotechnology in various fields such as physical, chemical, material and life sciences

Unit 3: Nanomedicines: Overview, medical uses of nanomaterials, Drug discovery and drug designing, nanorobots, nanophrology, cancer diagnostics – current approaches and challenges

Unit 4: Nanosensors: Predicted application, existing nanosensors, production methods, economic impact

Unit 5: Nanoparticles: Nanocluster, nanopowder, history and properties, classification and characteristics, nanoparticle morphology, biological applications

Text Books:

1. Pradeep, T. 2006. Nano. Tata McGraw Hill Publishers, India
2. Niemeyer, C.M. and Mirkin, C.A. 2006. Nanobiotechnology Concepts: Application and properties, Wiley VCH Publishers. New Delhi
3. Dinh, T.V. 2007. Nanotechnology in biology and medicine: Method, devices and applications, CRC Press.

Book for Reference:

4. Ratner, M. and Ratner, D. 2005. Nanotechnology: A gentle introduction to the next big idea. Pearson education. Inc.USA

Web site:

5. <http://en.wikipedia.org/wiki/Nanobiotechnology>

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Course: M.Sc., Bioresources Management

Code No : 2PR1

Semester: 2

No. of Hrs allotted: 75

Paper: Core

No. of Credits : 5

Title of the Paper: **MICROBIAL DIVERSITY AND UTILIZATION**

Marks: 25 + 75 = 100

Course Objective: To study microbial taxonomy, sampling techniques, applying microbial resources in environment, agriculture and industry

Unit 1: Microbial classification: Microbial taxonomy - definition and systematics, Nomenclature rules - hierarchy of taxonomic organization - phylogenetic and phenetic classification - Haeckel's three kingdom classification - Whittaker's five kingdom classification" criteria for classification - numerical taxonomy - Classification of bacteria based on Bergy's manual of Systematic bacteriology.

Unit 2: Sampling techniques: Collection of -soil, water and air - isolation and enumeration of microbes - plating techniques and viable cell count, direct microscopic count, turbidity methods - estimation of microbial biomass - biochemical and molecular markers methods, simple staining, differential staining, direct bacterial counts.

Unit 3: Microbes and environment: Metal scavenging microbes - mechanism of metal scavenging and detoxification. Microbial leaching - mechanism of metal resistance and detoxification - biodegradation of metals, pesticides, oil, detergents - metal sequestration, microbial biofilms, biosurfactants- bioavailability, factors affecting environmental degradation - Bioremediation - *In situ* and *ex situ*.

Unit 4: Microbes in Agriculture: Plant Growth Promoting Bacteria: Nitrogen fixers - *Rhizobium*, *Azotobacter*, *Azospirillum*, *Cyanobacteria* - mechanism of nitrogen fixation - Phosphate solubilizers and process - mass cultivation and application of nitrogen fixers and phosphate solubilizers - iron chelators and siderophore production Microbial control - definition, mechanism, microbial 'insecticides' - bacteria, fungi and virus (*Bacillus thuringiensis*, Nuclear Polyhedrosis Virus, Cytoplasmic Polyhedrosis Virus, (*Bauveria bassiana*) - formulations and applications.

Unit 5: Microbes in Industry: Primary screening - secondary screening of microbes of industrial importance - Industrial production of antibiotics (Penicillin, Streptomycin), organic acids (Acetic acid, citric acid), enzymes (amylase, protease), fuel (ethanol, methane) - Single Cell protein, recombinant DNA products (insulin, interferon)

Text Books:

1. Atlas, R.M. 1997. Principles of Microbiology. II edn. WCB/Mc Graw Hill Co USA.
2. Black, J.G. 1999. Microbiology - Principles and explorations. IV edn. John Wiley & Sons, Inc. New York.

Books for Reference:

3. Krieg, N.R. 1984. Bergey's Manual of Systematic Bacteriology. Volume 1 - IV.
4. Madigan, M.T., Martinko, J.M. and Parker, J. 2000. Brock-Biology of Microorganisms. IX edn. Prentice-Hall International, Inc., New Jersey.
5. Pelczar, M.J., Chan, E.C.S. and Krieg, N.R. 1986. Microbiology. McGraw Hill Book Co. Singapore.

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| | |
|--|-------------------------|
| Course: M.Sc., Bioresources Management | Code No : 2PR2 |
| Semester: 2 | No. of Hrs allotted: 75 |
| Paper: Core | No. of Credits : 5 |
| Title of the Paper: C – PROGRAMMING | Marks: 25 + 75 = 100 |

Course Objective

Understanding the language C, developing skills to write programming to manage Bioresources.

Unit 1: Constants, Variables, operators and Expressions: Character set keywords and identifiers - Constants - variables - data types - Declaration of variables- assigning values to variables - Defining symbolic constants - Arithmetic operators- Relational operators - Logical operators - Assignment operators – increment and decrement operators - conditional operators – Special operators - Arithmetic Expressions – types - Conversion operator - precedence- mathematical functions.

Unit 2: Input, output operators, Arrays and strings: Reading and writing characters formatted input and output - One dimensional arrays - Two dimensional arrays - initialization- multidimensional arrays - arithmetic operators on characters - string handling functions - table of strings.

Unit 3: Decision Making-Branching and Looping: Simple If statement - The if-else statement - Nesting of if-else statements - the else- if ladder - the switch statement - the?: operator - The GOTO statement - the while statement - the do statement - the for statement- jumps in loops

Unit 4: The form of C functions - categories of functions - function - nesting of functions- recursion - functions with arrays - the scope and lifetime of variable in functions.

Unit 5: Structure, Unions, Pointers and File management: Structure - definition - giving values to members - structure initialization - comparison of structure variables - arrays within structures - structures within structures - unions – understanding pointers - accessing the address of the variable - declaring pointer variables-initialization of pointer variables - accessing a variable through its pointer - pointers and arrays - pointer and character strings - defining and opening a file - closing a file - input/output operations on files.

Text Book:

1. Balagurusamy, E. 2004. Programming in C. III edn. Tata McGraw Hill Publishing Ltd., New Delhi.

Book for Reference:

2. Kanetkar, Y. 2005. Let us C. BPB Publications. VI edn. New Delhi.

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Course: M.Sc., Bioresources Management

Code No : 2PRL1

Semester: 2

No. of Hrs allotted: 120

Paper: Lab for 2PR1

No. of Credits : 4

Title of the Paper: LAB IN **MICROBIAL DIVERSITY AND UTILIZATION**

Marks: 40 + 60 = 100

1. Isolation of microbes from air, soil and water
2. Determination microbial diversity/biomass - direct colony count, cell count, turbidity
Methods
3. Estimation of Metabolic diversity of microbes
4. Microbial degradation of pesticides
5. Isolation of nitrogen fixers from leguminous plants.
6. Isolation of siderophore producers and characterization of siderophore
7. Screening of industrially important microbes
8. Production of citric acid
9. Production of amylase
10. Cultivation of microorganisms for the production of single cell proteins

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Course: M.Sc., Bioresources Management

Semester: 2

Paper: Lab for 2PR2

Title of the Paper: **C – PROGRAMMING**

Code No : 2PRL2

No. of Hrs allotted: 105

No. of Credits : 4

Marks: 40 + 60 = 100

1. Write a program to find mean, median, mode for the given data on Bioresources
2. Write a program to find the standard deviation for the given data on Bioresources
3. Write a program to fit a straight by the method of least square for the given data on Bioresources
4. Write a program to fit regression lines for the given data on Bioresources
5. Write a program to maintain Bioresources using files

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| | |
|--|-------------------------|
| Course: M.Sc., Bioresources Management | Code No : 2PRE1 |
| Semester: 2 | No. of Hrs allotted: 75 |
| Paper: Elective -2 | No. of Credits : 4 |
| Title of the Paper: BIODIVERSITY AND CONSERVATION | Marks: 25 + 75 = 100 |

Course Objective

To gain knowledge on biodiversity, its measurement, threat, loss and strategies to conserve biodiversity.

Unit 1: Biodiversity - definition - patterns of diversity: Genetic diversity, Species diversity, Ecosystem diversity, Guild diversity - Ecosystem stability; equilibrium and non equilibrium - succession - patterns of specie richness during succession - biotic interaction and succession.

Unit 2: Sampling methods - quadrat, transect, pit fall, traps, mark-recapture, all out search. Aquatic insect sampling - Species richness and abundance - Measures of diversity: alpha, beta and gamma diversity - Diversity indices: dominance and evenness.

Unit 3: Species richness gradients - abiotic and biotic theories, Global species richness, rarity and abundance, Biodiversity hot spots - indicator species - keystone species.

Unit 4: IUCN categories of extinction - red data book - Causes for species extinction: habitat fragmentation, destruction, over exploitation - Species behaviour - Impact of exotic species on native species - GMOs and biodiversity - impact of human population and urbanization on Biodiversity. Intellectual Property Rights - GATT, WTO, Farmer's and breeder's right. Biodiversity act

Unit 5: Conservation: *In situ* Conservation - Biosphere reserve - National Parks - Wild life sanctuaries; *Ex situ* conservation - cryopreservation - Germplasm conservation, gene bank, seed bank, pollen bank, tissue culture, community gene bank; *In situ* On farm conservation - Community gardens, home gardens; Ecotourism.

Text Books:

1. Agarawal, K.C.2000. Biodiversity. Agrobios. Jodhpur.
2. Stiling,P. 2002. Ecology - Theories and applications. Printice-Hall of India. Pvt.Ltd. New Delhi.

Books for Reference:

3. Gurevitch,J. Scheiner,S.M. and Fox,G.A. 2002. The Ecology of Plants. Sinauer associates, Inc., Publishers. Massachusetts.
4. Krishnamoorthy,K.V. 2004. An advanced Text Book of Biodiversity. Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi.
5. Meffe, G.K. and Carrol, R.C. 1994. Principles of Conservation Biology, Sinauer Associates, Inc., Publishers, Saunders.

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Course: M.Sc., Bioresources Management

Code No : 2PRE1

Semester: 2

No. of Hrs allotted: 75

Paper: Elective -2

No. of Credits : 4

Title of the Paper: **ENVIRONMENT AND CONSERVATION BIOLOGY**

Marks: 25 + 75 = 100

Course Objective:

- To introduce various concepts of Ecosystem
- To educate various sources of Pollution
- To educate for the development of ideas in the biodiversity conservation
- To make involve in the urban ecology study

Unit 1: Ecosystem: Ecosystem concept and dynamics – Abiotic and biotic components, energy input in ecosystem, Biomass, primary and secondary production – Concept of food chain and food web – community organization – Concept of habitat, functional role and niche – ecotone – edge effect – ecological succession.

Unit 2: Pollution: Air Pollution – Sources of air pollution – Global warming – Ozone depletion – Green house effect – Acid rain. Water pollution – sources – eutrophication – algal bloom – BOD – Biomagnification – Thermal pollution – Radioactive pollution – Land pollution.

Unit 3: Biodiversity: Biodiversity – Convention on Biological Diversity – levels and patterns of Biodiversity – local, regional, national and global diversity – Genetic, species, Ecosystem and functional diversity – measurement of biodiversity and diversity indices – indicator species – Keystone species – endemism – hot spots of biodiversity – Landscape elements and types – values of Biodiversity – Gene, food, medicine and Ecotourism

Unit 4: Biodiversity loss and conservation: Causes for biodiversity loss – IUCN categories of threatened species – Red Data Book. Conservation of biodiversity – *in situ* conservation – Biosphere reserve Wild life sanctuaries and National parks – *ex situ* conservation – Gene bank, seed bank, cryopreservation

Unit 5: Urban ecology: Demographic structure and characteristics – population explosion – Urban settlement – Central and Extension areas – Causes of urbanization – Housing – transport – waste disposal – Solid and liquid waste – Industries and Environmental Impact Assessment – Remote Sensing to Environmental impact assessment – Role of remote sensing in environmental impact assessment.

Text Books:

1. Agrawal, K.C. 1999. Biodiversity. Agrobotanical Publishers. New Delhi.
2. Briggs, D., Smithson, P., Addison, K. and Atkinson, K. 1997. Fundamentals of Physical Environment. II edn. Routledge, UK;
3. Chang, K. 2002. Geological Information System. Tata McGraw Hill Publishers. New Delhi.
4. Cunningham, W.P. and Saigo, B. W. 1999. Environmental science. Vth edn. Tata McGraw Hill Publishing Co., New Delhi.
5. Joseph, and Nagendran, R. 2005. Essentials of environmental studies. II reprint.
6. Krishnamoorthy, K. V. 2004. An Advanced Text Book of Biodiveristy – Principles and Practice. II reprint. Oxford & IBH Publishing Co. Pvt. Ltd. New Delhi.
7. Mackenzie, N., Ball, A.S. and Virdee, S. R. 1999. Instant notes in Ecology. Viva Books Pvt. Ltd. New Delhi.

Books for Reference:

8. Meffe, G.K. and Carroll, C.R. 1994. Principles of Conservation Biology. Sinauer Associates, Inc., USA.
9. Odum, E.P. 1996. Fundamentals of Ecology. Nataraj Publishers. Dehradun.
10. Scanvic, J.Y. 1997. Aerspatial Remote Sensing in Geology. Oxford & IBH publishing Co. Pvt. Ltd. New Delhi
11. Stiling, P. 2004. Ecology – Theories and applications. Prentice Hall of India Pvt. Ltd. New Delhi.

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| | |
|--|-------------------------|
| Course: M.Sc., Bioresources Management | Code No : 3PR1 |
| Semester: 3 | No. of Hrs allotted: 90 |
| Paper: Core | No. of Credits : 5 |
| Title of the Paper: FOREST RESOURCES AND MANAGEMENT | |

Marks: 25 + 75 = 100

Course Objective:

To understand distribution pattern of forests, importance of forest genetic resources **and** applications of biotechnology in forestry, management principles and industrial use of forests

Unit 1: World Forest geography - factors influencing the distribution of forest - forests and environment, national forest policies - human forest relationships – tree felling and regeneration – forest cycle – sustainable harvest and yield – minor forest products .forestry and agriculture; forest fire, shifting cultivation, grazing, energy sources

Unit 2: Forest and wild life management: Objectives and principles – natural and anthropogenic causes - problems and remedial measures – Joint Forest Management silvicultural practices – social Forestry – farm forestry – agroforestry – plantation forestry – mono culture and mixed culture - issues

Unit 3: Forest genetic resources: Introduction - current status of forest genetic resources in India - challenges for forest genetic resources: biological - socio economical challenges. Genetically superior propagules - vegetative propagation - and establishment of clonal banks - seed orchards – micropropagation

Unit 4: Forest biotechnology: Genomics and proteomics in forestry - application of microarray technology in forestry - molecular markers and certification of plant materials – GMOs and forestry: GMOs and biosafety in forestry, field trials and operational applications of GMOs in forestry

Unit 5: Forest industries: Timber and firewood industries, plywood industry, paper industry, match industry - economic, political and public aspects of forestry, pests of wood industry

Text Books:

1. Burton, L.D. 2000. Introduction to Forestry Science. Delmer Publishers, London.
2. EI- Kassaby, Y.2004. Feasibility and proposed outline of a global review of forest biotechnology.
3. Forest Genetic Resources Working Paper FGR/77E. Forest Resources Development Service, Forest Resources Division. FAO, Rome.
4. Kellison, R., Mc Cord, S. Gartland, K.M.A. (Eds.). 2004. Forest Biotechnology in Latin America. Proceedings from the workshop biotechnological forestall. Global Biotech. Form, March 2-5, 2004, Concepcion, Chile.

Books for Reference:

5. Owusu, R.A. 1999. Gm Technology in the forest sector. A scoping study for WWF. [http://forests.org /archive/general/gmtechsc.html](http://forests.org/archive/general/gmtechsc.html)
6. Puri,G.S. Mehar-Homji,V.M., Gupta, R.K. and Puri,S. 1960. Forest ecology. Oxford & IBH Publishing Co. Pvt. Ltd. New Delhi.
7. Ravindranath, N.H. Murali, K.S. and Malhotra, K.C. 2000. Joint Forest Management and community forestry in India. Oxford & IBH Publishing Pvt. Ltd. New Delhi.
8. Sagreta, K.P. 2000. Forests and Forestry. National Book Trust India, New Delhi.
9. Sykes, M.1999.Biotechnology: working with nature to improve forest resources and products. International Environmental conference, TAPPI proceeding pp.630- 637.
10. Uma Shananker, R., Ganeshaiah, K.V. and Bawa, K.S. (eds). 2001. Forest Genetic Resources. Oxford & IBH, New Delhi

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| | | |
|--|----------------------|---------------|
| Course: M.Sc., Bioresources Management | Code No | : 3PR2 |
| Semester: 3 | No. of Hrs allotted: | 90 |
| Paper: Core | No. of Credits | : 5 |
| Title of the Paper: MARINE RESOURCES AND MANAGEMENT | Marks: | 25 + 75 = 100 |

Course Objectives: To study various marine resources, their monitoring, sustainable utilization and conservation

Unit 1: Introduction to marine resources: Different strata of Oceanic habitat and their interaction with marine life- Introduction to Marine Biodiversity: Phytoplankton, Zooplankton, Benthos, Seaweeds and Sea grasses. Water bloom-Toxic Dinoflagellates -Bioluminescence. Primary productivity, Marine food web and food chain. Distribution pattern of sea weed resources in Indian Seas.

Unit 2: Tools for monitoring marine resources: Measuring phytoplankton populations and primary productivity: sampling methods Tracer technique and Chlorophyll measurement. Assessment of Marine resources-Quadrat method, transect method. Parameters in assessment - Biomass, density, percentage occurrence, species abundance, richness and evenness.

Unit 3: Seaweeds and Aquaculture: Chapman's algal Classification. Herbarium preparation. Seaweed cultivation - global scenario. Types of cultivation-vegetative and spore. Culture under controlled condition (outdoor tanks and laboratory) and open sea cultivation. Factors involving in seaweed aquaculture - Economic importance of seaweeds. Pearl culture - Prawn culture - Aquarium management.

Unit 4: Pollution management in marine environment: Types of marine pollution and Eutrophication. Removal of pollutants- Primary, Secondary and Tertiary treatment. Monitoring of heavy metal pollution using phytoplankton and seaweeds, -effects of pollution in marine environment. Laws of pollution regulatory act.

Unit 5: Socio economic status and marine protected areas: Marine Biosphere Reserve and Marine National Park. Livelihood, generation from marine resources-Sustainable management of marine resources through mariculture practices - Marine Wild life trafficking - marine bioinvasion.

Text Books:

1. Arnon, 1978, '88, & '93. A report on the seaweeds resources of Tamil Nadu. Central salt and marine fisheries research institute. Cochin.
2. Austin.1992. Marine Microbiology. Cambridge press. London
3. Balakrishanan Nair, N & D.M. Thampy.1980. A text book of marine ecology. The Mac Millan Co., of India Ltd. .
4. Boney,A.D. 1989. Phytoplankton - New studies in Biology -Edward Arnold - London pp 118.
5. Imai, LT. 1982. Progress in shallow sea culture techniques of seaweed culture. Tokyo: Koseisha Koseika publishers
(English translation) pp.111.

Books for Reference:

6. Krishnamurthy,V. 2000. Algae of India and neighbouring countries. Oxford & IBM Publ.pp. 203
7. Peter McRoy, C. & Helderich,G. 1977. Seagrass Ecosys. A Scientific resperctive Marcel Deker Inc., New York.
8. Raymont.J. 1963. Plankton and productivity in the Ocean, Pergamon Press. London.
9. Subba Rangaiah,G.1999.Recent trends in Algal Research. Publisher-Marine Algal Laboratory. A.P. India
10. Sundaralingam,V. 1991. Marine Algae, Bishan Singh and Mahendra Pal Singh Publishers, Dehradun.
11. Venkataraman,G.S. 1974. Algae: Form and Function. Today's & Tomorrow's publishers, New Delhi.
12. Waldichunk. M. 1977. Global Marine Pollution: an Overview. UNESCO. Paris.

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|--|----------------------|---------------|
| Course: M.Sc., Bioresources Management | Code No | : 3PRL1 |
| Semester: 3 | No. of Hrs allotted: | 120 |
| Paper: Lab for 3PR1 | No. of Credits | : 5 |
| Title of the Paper: FOREST RESOURCES AND MANAGEMENT | Marks: | 40 + 60 = 100 |

1. Vegetation analysis in successional community and climax forests
2. Estimation of volume of standing crops
3. Nursery techniques
4. Analysis of soil seed bank
5. Propagation of selected plants through tissue culture procedure
6. Isolation of genomic DNA from plant tissue
7. Electrophoretic separation of isolated DNA
8. Identification of common medicinal plants
9. Visit to forest
10. Industrial visit

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Course: M.Sc., Bioresources Management

Code No : 3PRL2

Semester: 3

No. of Hrs allotted: 120

Paper: Lab for 3PR2

No. of Credits : 5

Title of the Paper: **MARINE RESOURCES AND MANAGEMENT**

Marks: 40 + 60 = 100

1. Laboratory analysis of seawater samples.
2. Measurement of productivity - Light and Dark bottle method.
3. Culture media preparation for micro and macro algae.
4. Study of external and internal structure of some available macroscopic seaweeds
5. Extraction and processing of agar agar and Carrageenan from red seaweeds
6. Extraction and processing of alginates from marine kelp (Brown algae).
7. Extraction of Chlorophylls and Carotenoids from Marine Green Algae.
8. Preparation of Sea Weed Liquid Fertilizers (SLF) from brown and red seaweeds
9. Effect of SLF on Seed germination.

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Course: M.Sc., Bioresources Management

Code No : 3PRE1

Semester: 3

No. of Hrs allotted: 30

Paper: Non-major Elective

No. of Credits : 2

Title of the Paper: **BIORESOURCES MODELLING & REMOTE SENSING**

Marks: 15 + 35 = 50

Course Objective: To understand concepts and application of modelling and remote sensing
In Bioresources management

Unit 1: Introduction - need for modelling – Components and Characteristics of modelling - Basic mathematical models. Bioresources Modelling - Estimation of Ecological parameters - an approach to development ecological model. Types of Ecosystem models

Unit 2: Introduction - Principle - Components - Aerial Remote Sensing - Satellite Remote Sensing - Remote Sensing for Environmental Analysis - - GIS & GPS - GIS in bioresources management.

Text Books:

1. Britton, N.F. 2004. Essential Mathematical Biology. Springer-verlag, New Delhi
2. Kapur, J.N. 2005. Mathematical Modelling. New Age International Publishers Ltd., New Delhi.

Books for Reference:

3. Green, D.G. 1990. Cellular automata models of crown-of-thorns outbreaks. In: Acanthaster and the coral reef: A Theoretical perspective. Springer-verlg, New York.
4. Rumbaugh, J., Blaha, M., Premerlani, W., Eddy, F. and Lorenzen, W. 1991. Object oriented ecosystem modelling and Desingn. Printice-Hall, New Jershy.

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|--|----------------------|--------|
| Course: M.Sc., Bioresources Management | Code No | : 4PR1 |
| Semester: 4 | No. of Hrs allotted: | 75 |
| Paper: Core | No. of Credits | : 5 |
| Title of the Paper: BIOINFORMATICS AND BIORESOURCES ENGINEERING | | |
| Marks: 25 + 75 = 100 | | |

Course Objective: To understand computer aided biological data base analysis, sequence alignment, information retrieval systems and drug designing

Unit 1: Bioinformatics - introduction - biological data bases - nucleotide sequence data bases, protein sequence data bases, specialized sequence data bases. Data retrieval and analysis, sequence and retrieval system.

Unit 2: Sequence alignment - sequence similarity searches, amino acid substitution matrices, Data base searches - FASTA, BLAST - PSI BLAST. Multiple sequence alignment – Clustered W: Phylogenetic analysis, PHYLODRAW: Phylogenetic tree.

Unit 3: Structural Bioinformatics: protein structure prediction - secondary structure prediction - Rasmol, microarray, SAGE.

Unit 4: Computer - assisted new lead design: Introduction - Basic concepts: ligand, receptor, molecular recognition of ligand by receptor. Handling X - ray structures of protein and ligands. Docking problem and Docking method: automatic Docking method: DOCK ADAM- applications of ADAM docking - active conformation, function - approaches to discover new functions. Scope and limitations.

Unit 5: Drug discovery and development process: New lead discovery - lead optimization - preclinical lead development - clinical development - post marketing surveillance.

Text Books:

1. Attwood; T.K. and Parry-Smith. 2001. Introduction to Bioinformatics. Pearson Education, Asia, New Delhi.
2. Baxevanis, A.D. and Qullette, B.F.F. 2001. Bioinformatics - Practical guide to analyse genes and proteins. Willey International Science Publications. New York.
3. Cohen, N.C. 2006. Guide book on molecular modelling in drug design. Elsevier, New Delhi.

Books for Reference:

4. Leach, R.A. 2001. Molecular modelling - Principles and Applications. Prentice Hall, New York.
5. Mount, W. 2001. Bioinformatics - Sequence and Genome analysis. Cold Springer Harber Laboratory Press, New York.
6. Twyman, R.H. 2003. Instant notes on Bioinformatics. Viva Books Ltd., New Delhi

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| | |
|--|-------------------------|
| Course: M.Sc., Bioresources Management | Code No : 4PR2 |
| Semester: 4 | No. of Hrs allotted: 75 |
| Paper: Core | No. of Credits : 5 |
| Title of the Paper: INTERNET AND JAVA PROGRAMMING | Marks: 25 + 75 = 100 |

Course Objective: To study basic principles of designing web pages, programming in Java and apply to monitor bioresources

Unit 1: Introduction to Internet - history and application - internet - extra net - Web Page _ connected to internet

Unit 2: Web page designing - HTML - Head and body tags - Anchor tag - Background and Text colour - Horizontal line - (HR) tag - lists - ordered and unordered lists - Print formatting - tables - tables with multiple cells - frames - tags.

Unit 3: Java - Introduction - characteristics - history - elements of Java - identifiers - literals - operators - objects and class- conditional structures - loops and arrays.

Unit 4: Graphics - drawing simple picture - windows programming in Java - creating simple windows - panels - canvas - GUI elements - buttons - text boxes - radio buttons Font class- Font matrices class - colour class - Data class

Unit 5: Applet - simple Java Applets - Java Applets with graphics - Java Applets with buttons - text boxes - Radio buttons - font classes.

Text Books:

1. John Zukowski, 2000. Mastering Java 2, BPB Publications, New Delhi.
2. Naughton, P. 2008. The Java Hand Book, 25th edition, Tata McGraw Hill Company, New Delhi.
3. Schildt, H. 2002. The complete reference Java 2. V edn, Tata McGraw Hill Publishing Co. Ltd., New Delhi.

Books for Reference:

4. Stout, R. 1996. The World Wide Web – Complete reference, McGraw Hill Publishers, Australia.
5. Horstmann C. S. and Cronell, G. 2008. Core Java Volume –I Fundamentals, Eighth edition, Prentice Hall International, USA.
6. Xavier, C. 2001. World Wide Web Designing with HTML. III reprint. Tata McGraw Hill Publishing Co. Ltd., New Delhi.

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Course: M.Sc., Bioresources Management

Code No : 4PRL1

Semester: 4

No. of Hrs allotted: 120

Paper: Lab for 4PR1

No. of Credits : 4

Title of the Paper: **BIOINFORMATICS & BIORESOURCES ENGINEERING**

Marks: 40 + 60 = 100

1. Bioresource sequence retrieval from data bases
2. Sequence file format conversion
3. Pairwise Sequence Alignment - BLAST and FASTA
4. Multiple Sequence Alignment
5. Secondary structure prediction
6. Identification of structural domains to protein sequences
7. Computer aided Designing ligand for X ray structure of proteins
8. Bioengineering using DOCK - ADAM

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Course: M.Sc., Bioresources Management

Code No : 4PRL2

Semester: 4

No. of Hrs allotted: 105

Paper: Lab for 4PR2

No. of Credits : 4

Title of the Paper: **INTERNET AND JAVA PROGRAMMING**

Marks: 40 + 60 = 100

1. Internet searching data on bioresources
2. Write a HTML program to documents the images of Bioresources
3. Write a HTML Document to link websites of Bioresources
4. Designing web pages for Bioresources
5. JAVA coding using inheritance
6. JAVA coding using multi threading
7. Simple Applet Programs

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Course: M.Sc., Bioresources Management

Code No : 4PRE1

Semester: 4

No. of Hrs allotted: 75

Paper: Elective -3

No. of Credits : 5

Title of the Paper: **PROJECT**

Marks: 40 + 60 = 100

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