Ahmednagar Jilha Maratha Vidya Prasarak Samaj's

New Arts, Commerce and Science College, Ahmednagar

(Autonomous)

(Affiliated to Savitribai Phule Pune University, Pune)

Choice Based Credit System (CBCS)

Bachelor of Science (B. Sc.)

Syllabus of

S. Y. B. Sc. Botany

Implemented from

Academic year 2022 -23

Ahmednagar Jilha Maratha Vidya Prasarak Samaj's

New Arts, Commerce and Science College, Ahmednagar (Autonomous)

Board of studies in Botany

Sr. No.	Name	Designation
1.	Dr. C. S. Arsule	Chairman
2.	Dr. D. D. Ahire	Member
3.	Dr. Y. R. Gahile	Member
4.	Dr. P. P. Sharma	Academic Council Nominee
5.	Dr. M. L. Ahire	Academic Council Nominee
6.	Dr. S. G. Auti	Vice-Chancellor Nominee
7.	Mr. D. K. Jadhav	Alumni
8.	Dr. S. A. Punekar	Industry Expert
9.	Mr. A. S. Wani	Member (co-opt)
10.	Dr. A. A. Kulkarni	Member (co-opt)
11.	Dr. B. N. Sonawane	Subject Expert

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New Arts, Commerce and Science College, Ahmednagar (Autonomous)

Syllabus of S. Y. B. Sc. Botany
under
Faculty of Science

Semester-III	**Paper-I**
Course Code : BSC-BO301 T	**Title of Course :** Taxonomy of Angiosperms and Plant Ecology
Credits: 02	**Total lecture:** 30 Hours

Course outcomes:

On completion of program students will be specifically able to

1) Know about the systematic position of Generas, Species and, Families.
2) The students develop knowledge about plant nomenclature.
3) Learn about various systems of classification of Angiosperms
4) Learn about various Angiosperm families.
5) Understand various methods of vegetation sampling
6) Learn about ecological adaptations in plants

Detailed syllabus:

Credit-I **(15 Hours)**

UNIT I: Introduction to Angiosperms Taxonomy **(2)**

1.1 Definition, scope, objectives and importance of taxonomy,

1.2 Exploration, Description, Identification, Nomenclature and classification, Concept of Systematics with brief historical background

UNIT II: Systems of classification **(5)**

2.1 Comparative account of various systems of classification

2.2 Artificial system- Carl Linnaeus

2.3 Natural system- Bentham and Hooker

2.4 Phylogenetic system- Engler and Prantl

2.5 APG system- A brief review

UNIT III: Study of Plant Families **(8)**

3.1 Study of following families with reference to systematic position (As per Bentham and Hooker's system of classification), salient features, floral formula, floral diagram and any five examples with their economic importance – Annonaceae, Brassicaceae, Myrtaceaee, Rubiaceae, Solanaceae, Apocynaceae, Nyctaginaceae, Asteraceae and Amaryllidaceae

Credit-II **(15 Hours)**

UNIT I: Botanical Nomenclature **(5)**

1.1 Concept of nomenclature, brief history, Binomial nomenclature

1.2 International Code for Nomenclature of Algae, Fungi and Plants (ICN)/ICBN code, Rules and Recommendations;

1.3 Concept of Typification. Ranks and endings of taxa names, Coining of Genus and Species names Single, double and multiple authority citations

UNIT II: Introduction to ecology **(6)**

2.1 Definition, concept, scope, and interdisciplinary approach,

2.2 Autecology and Synecology.

2.3 Species diversity: definition, concept, scope, and types: Alpha, Beta and Gamma diversity.

2.4 Genetic Diversity: definition, nature and origin of genetic variations

2.5 Origin of species diversity, diversity indices,

2.6 Ecosystem Diversity: definition, major ecosystem types of the world,

2.7 Hotspots in India – concept and basis of 'hotspot' identification.

2.8 Methods of vegetation sampling: quadrat method, transect method, plot less method

UNIT III: Ecological grouping of the plants **(4)**

3.1 Ecological grouping of the plants with reference to their significance of adaptive external and internal features with examples:

a) Hydrophytes,

b) Mesophytes

c) Xerophytes

d) Halophytes.

Suggested Readings:

1. Balfour Austin (2016). Plant Taxonomy. Syrawood Publishing House
2. Chapman, J.L. and Reiss, M.J. (1998). Ecology: Principles and applications. Cambridge, University Press.
3. Chopra G.L. (1984). Angiosperms: Systematics and Life-Cycle., Pradeep Publications
4. Cooke, Theodore (1903-8). The Flora of the Presidency of the Bombay Vol. I, II, III (Repr. ed), Botanical Survey of India.
5. Cronquist, A. (1968). The Evolution and Classification of Flowering Plants. Thomas Nel and Sons Ltd. London.
6. Datta S.C. (1988). Systematic Botany. New Age Publ.
7. Davis P.H and V.H Heywood (1963). Principles of Angiosperm Taxonomy. Oliver and Boyd, London. 8. Heywood V.H. (1967). Plant Taxonomy, Hodder & Stoughton Educational, London.
8. Judd Walter S., Campbell, C. S., Kellogg, E. A., Stevens, P.F. and M. J. Donoghue. (2008). Plant Systematics- A Phylogenetic Approach. Sinauer Associates, INC, Publishers.Sunderland, Massachusetts, USA.
9. Kormondy Edward (1995). Concepts of Ecology, Pearson Publ.
10. Lawrence G.H.M. (1955). An Introduction to Plant Taxonomy. McMillan, New York.
11. Lawrence, G.H.M. (1951). Taxonomy of Vascular Plants. McMillan, New York.
12. Michael P. (1984). Ecological Methods for field and Laboratory investigations TMH Co. ltd. Bombay. 14. Mondol A.K. (2016) Advanced Plant Taxonomy, New Central Book Agency (NCBA)
13. Naik V.N. (1988) Taxonomy of Angiosperms. Oxford and IBH
14. Odum E.P., (2004). Fundamentals of Ecology, Publ. Cengage Learning, Australia
15. Pande B.P. (1997). Taxonomy of Angiosperms. S. Chand.
16. Pande B.P. (2001) Taxonomy of Angiosperms. S. Chand.
17. Radford A.E. 1986. Fundamentals of Plant Systematics, Harper and Row N Y.
18. Santapau H. (1953). The Flora of Khandala on the Western Ghats of India. BSI
19. Sharma O.P. (2011), Plant Taxonomy, Tata Mc grow Hill
20. Shivrajan V.V. & N.K.P. Robson (1991). Introduction to Principles of Plant Taxonomy. Cambridge Univ. Press
21. Shukla Priti and Shital Mishra (1982). An introduction to Taxonomy of angiosperms. Vikas Publ.
22. Simpson, M.G. (2010). Plant Systematics. Elsevier, Amsterdam.
23. Singh Gurucharan (2005). Systematics: Theory and Practice. Oxford IBH.
24. Singh J.S., S.P. Singh, and S.R. Gupta (2006). Ecology, Environment and Resource Conservation. Anamaya Publ. New Delhi.
25. Singh N.P. (2001) Flora of Maharashtra Volume-II BSI, Kolkatta
26. Singh N.P. (2003) Flora of Maharashtra Volume-III BSI, Kolkatta
27. Singh N.P., S. Karthikeyan (1996) Flora of Maharashtra Volume-I, BSI, Kolkatta
28. Singh V. and D.K. Jain, (1981). Taxonomy of Angiosperms. Rastogi Publication, Meerut.
29. Singh, Gurcharan. (2012). Plant Systematics: Theory and Practice. Completely revised and enlarged 3rd edition. Oxford & IBH, New Delhi.

30. Stuessy, Tod F. (2009). Plant Taxonomy: The Systematic Evaluation of Comparative Data, second edition. Columbia University Press.
31. Swingle D.B. (1946). A Text book of Systematic Botany. McGraw Hill Book Co. New York.
32. Takhtajan A. (1969). Flowering Plants: Origin and Disposal.

IMPORTANT WEBSITES

- THE FAMILIES OF FLOWERING PLANTS- L. Watson and M.J. Dallwitz https://www.delta-intkey.com/angio/index.htm
- ANGIOSPERM PHYLOGENY WEBSITE, version 14. http://www.mobot.org/MOBOT/research/APweb/
- THE PLANT LIST- http://www.theplantlist.org
- THE PLANTS OF THE WORLD ONLINE PORTAL http://www.plantsoftheworldonline.org/
- INTERNATIONAL PLANT NAME INDEX (IPNI) https://www.ipni.org/
- TROPICOS https://www.tropicos.org/home
- BIODIVERSITY HERITAGE LIBRARY https://www.biodiversitylibrary.org/
- BOTANICUS DIGITAL LIBRARY https://www.botanicus.org/
- INTERNET ARCHIVE- DIGITAL LIBRARY https://archive.org/
- DATABASE OF PLANTS OF INDIAN SUBCONTINENT https://sites.google.com/site/efloraofindia/
- BOTANICAL SURVEY OF INDIA https://bsi.gov.in/content/1416_1_FloraofIndia.aspx
- FLOWERS OF INDIA http://www.flowersofindia.net/
- eFLORAS OF WORLD http://www.efloras.org/

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Semester-III	**Paper-II**
Course Code : BSC-BO302 T	**Title of Course :** Plant Physiology
Credits: 02	**Total lecture:** 30 Hours

Course outcomes:

On Completion of this Course students will be able

1) To understand plant physiological processes, pathways and their importance.
2) To clarify the mechanism and breaking of seed dormancy
3) Acquire knowledge about nitrogen fixing bacteria.
4) To understand process of nitrogen metabolism in plants
5) To understand the concept of photoperiodism and vernalization process and their importance.

Detailed syllabus:

Credit I: **(15 Hours)**

UNIT I. Introduction to Plant Physiology **(2)**

1.1 Scope and applications of plant physiology

UNIT II: Absorption of water **(3)**

2.1 Role of water in plants
2.2 Pathway and Mechanisms of water absorption
2.3 Factors affecting rate of water absorption

UNIT III: Ascent of sap **(3)**

3.1 Introduction and definition.
3.2 Transpiration pull or cohesion-tension theory, evidences and objections
3.3 Factors affecting ascent of sap

UNIT IV: Transpiration **(7)**

4.1 Definition
4.2 Types of transpiration – cuticular, lenticular and stomatal
4.3 Structure of stomata
4.4 Mechanism of opening and closing of stomata –Steward's hypothesis, active K+ transport mechanism
4.5 Factors affecting the rate of transpiration

4.6 Significance of transpiration
4.7 Antitranspirants
4.8 Guttation
4.9 Exudation

Credit II: **(15 Hours)**

UNIT I: Nitrogen metabolism **(7)**

1.1 Introduction and role of nitrogen in plants
1.2 Biological Nitrogen fixation -
1.2.1 Symbiotic nitrogen fixation,
1.2.2 Non-symbiotic nitrogen fixation
1.3 Nitrogenase enzyme- structure and function
1.4 Denitrification, ammonification and nitrification
1.5 Reductive amination and transamination
1.6 Importance and production technique of BGA

UNIT II: Seed dormancy and germination **(4)**

2.1 Definition, types of seed dormancy
2.2 Methods to break seed dormancy
2.3 Seed germination and types
2.4 Metabolic changes during seed germination
2.5 Role of phytohormones to improve seed germination
2.6 Vigor Index

UNIT III: Physiology of flowering **(4)**

3.1 Photoperiodism – Concept, definition, short day plants, long day plants and day neutral plants.
3.2 Phytochrome theory, role of phytohormones in induction and inhibition of flowering
3.3 Applications of photoperiodism
3.4 Vernalization–concept and definition, mechanism of vernalisation, applications of vernalisation and devernalization.

Suggested Readings:

1. Bidwell, R.G.S. 1974. Plant Physiology. Macmillan Pub. Co., N.Y.
2. Taiz, L. and Zeiger, E. 2006. Plant Physiology. 4th Edition. Sinnauers Associates, Saunders land, Massachusetts, USA
3. Salisbury F.B. and Ross C.B. 2005. Plant Physiology. 5th Edition. Wadsworth Publishing Co. Belmont CA.
4. HelgiOPik, Stephen A. Rolfe, Arthur J. Willis. 2005. The Physiology of Flowering Plants, Cambridge University Press, UK
5. Kirkham, M.B. 2004. Principles of Soil and Plant Water Relations. Elsevier, Amsterdam, Netherlands.

6. Dennis, D.T., Turpin, D.H., Lefebvre, D.D. and Layzell, D.B. 1997. Plant Metabolism. 2nd Edition. Longman Group, U.K.
7. Fitter, A. and Hay, R.K.M. 2001. Environmental Physiology of Plants. Academic Press, UK.
8. Press, M.C., Barker, M.G., and Scholes, J.D. 2000. Physiological Plant Ecology, British Ecological Society Symposium, Volume 39, Blackwell Science, UK.
9. SayyedIliyas, 2020. Steps in Plant Physiology, Lambert Academic Publishing, Mauritius.
10. Devlin, R.M. and F.H. Witham. 1983. Plant Physiology. Willard Grant Press. U.S.A.
11. Hans-Walter Heldt. 1997. Plant Biochemistry and Molecular Biology. Oxford University Press, New York.
12. Moore, T.C. 1979. Biochemistry and Physiology of Plant Hormones. SpringerVerlag. Berlin.
13. Raman, K. 1997. Transport Phenomena in Plants. Narosa Publishing House. New Delhi.
14. Jain, V.K. 2000: Fundamentals of Plant Physiology. S. Chand & Co, New Delhi.
15. Pandey, S.N. 1991: Plant Physiology, Vikas Publishing House (P) Ltd., New Delhi, India.
16. Verma, V. 200): Text Book of Plant Physiology, Ane Books India, New Delhi.
17. Nobel, P.S. 2009. Physicochemical and Environmental Plant Physiology.4th edition Academic Press, UK.

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Semester-III	**Paper-III**
Course Code : BSC-BO303 P	**Title of Course :** Practicals based on BO 301 and BO 302
Credits: 02	**Total lecture:** 30 Hours

Practicals:

Taxonomy of Angiosperms and Plant Ecology

1. Study of tools of taxonomy (any six) **(1P)**
2. Description of flowering plant in botanical terms **(1P)**
3. Study of plant families (any Six) **(3P)**
4. Preparation of herbarium **(1P)**
5. Study of ecological instruments (any six) **(1P)**
6. Study of ecological adaptations in Hydrophytes with any two examples **(1P)**
7. Study of ecological adaptations in Xerophytes with any two examples **(1P)**
8. Study of vegetation by list count quadrat method. **(1P)**

Plant Physiology

1. Introduction to laboratory instruments. **(1P)**
2. Determination of Diffusion Pressure Deficit (DPD) **(1P)**
3. Determine rate of transpiration under different conditions of Sunlight, Shade and wind **(1P)**
4. Demonstration of the following **(1P)**
    a. Commercial biofertilizers
    b. Imbibition in seeds
    c. Ringing experiment
    d. Transpiration pull
    e. Azolla / BGA culture
5. Perform phytochemical test for starch and protein in germinating and non germinating seeds **(1P)**
6. Calculate seed germination percentage and vigor index **(1P)**
7. Botanical study tour / field visit/ visit to Floriculture industry / Soil testing center / Seed testing center / biofertilizer unit / Regional research centre **(1P)**

N.B. Botanical excursion tour and compulsory submission of report along with herbarium of any five weeds of the following (List of Weeds attached).

Sr. No	Botanical Name	Common Name	Family
1.	*Abutilon indica* (L.) Sweet	Mudra, petari	Malvaceae
2.	*Acalypha indica* L.	Kholaki	Euphorbiaceae
3.	*Achyranthes aspera* L.	Aghada	Amaranthaceae
4.	*Alternanthera sessilis* (L.) R.Br. ex DC.	Chibu kata	Amaranthaceae
5.	*Amaranthus plyganym* L.	Tandulcha	Amaranthaceae
6.	*Amaranthus spinosus* L.	Kate math	Amaranthaceae
7.	*Argemone mexicana* L.	Bilayat, Pivla Dhotra.	Papaveracae
8.	*Asclepias curassavica* L.	Halad kunku	Apocynaceae
9.	*Blumea eriantha* DC.	Jangali Tambaku	Asteraceae
10.	*Blumea lacera* (Burm.f) DC.	Bhamurdi	Asteraceae
11.	*Boerhavia erecta* L.	Pandhari punarnava	Nyctaginaceae
12.	*Brassica arvensis*	Ranmohari	Brassicaceae
13.	*Cassia occidentalis* L.	Kasivda, kasoda	Caesalpiniaceae
14.	*Cassia pumila* Lam.	Sarmal	Caesalpiniaceae
15.	*Cassia tora* L.	Takla, Tankala	Caesalpiniaceae
16.	*Celosia argentea* L.	Kurdu, kombda	Amaranthaceae
17.	*Chenopodium album* L.	Chandanbawta	Amaranthaceae
18.	*Cleome viscosa* L.	Pivali tilavan	Capparaceae
19.	*Cronton bonplandianum* Baillon	Ban tulsi	Euphorpiaceae
20.	*Crotalaria pallida* Dryand	Jungli tag	DryandFabaceae
21.	*Cryptostegia grandiflora* R.Br.	Kavali	Apocynaceae
22.	*Cuscuta chinensis* Lam.	Amarvel	Cuscutaceae
23.	*Cuscuta reflexa* Roxb.	Golden dodder	Cuscutaceae
24.	*Cynodon dactylon* (L.) Pers.	Durva, Haral	Cyperaceae
25.	*Cyperus difformis* L.	Small flower umbrella	Cyperaceae
26.	*Datura innoxia* Mill.	Dhotra	Solanaceae
27.	*Cleome viscosa* L.	Pivali tilavan	Capparaceae
28.	*Cronton bonplandianum* Baillon	Ban tulsi	Euphorpiaceae
29.	*Crotalaria pallida* Dryand	Jungli tag	DryandFabaceae
30.	*Cryptostegia grandiflora* R.Br.	Kavali	Apocynaceae
31.	*Echinops echinatus* Roxb.	Bramhadandi	Asteraceae

32.	*Eclipta prostrata* L.	Maakaa	Asteraceae
33.	*Eichhornia crassipes* (Mart.) Solms	Jalparni	Pontederiaceae
34.	*Emilia sonchifolia* (L.) DC.	*Sadamandi*	Asteraceae
35.	*Euphorbia hirta* L.	Dudhi	Euphorbiaceae
36.	*Hyptis suaveolens* (L.) Poit.	Drap Tulas	Lamiaceae
37.	*Ipomoea carnea* Jacq.	Besharam	Convolvulaceae
38.	*Ipomoea hederifolia* L.	Lal Pungli	Convolvulaceae
39.	*Ipomoea obscura* (L.) Ker Gawl.	Pivali Pungali	Convolvulaceae
40.	*Ipomoea pes-tigridis* L.	Tiger's Footprint	Convolvulaceae
41.	*Lagascea mollis* Cav.	Jharwad	Asteraceae
42.	*Lantana camara* L.	Ghaneri	Verbenaceae
43.	*Leonitis nepetaefolia* (L.) R. Br.	Deepmal	Lamiaceae
44.	*Leucas aspera* L.	Dudhani	Lamiaceae
45.	*Martynia annua* L.	Vinchu	Pedaliaceae
46.	*Mecardonia procumbens* (Mill.) Small	Makardana	Scrophulariaceae
47.	*Oxalis corniculata* L.	Amboti	Oxalidaceae
48.	*Parthenium hysterophorus* L.	Congres gawat	Asteraceae
49.	*Phyllanthus niruri* L.	Bhuiawla	Phyllanthaceae
50.	*Physalis minima* L.	Ran-popti	Solanaceae
51.	*Pistia stratiotes* L.	Akashamuli	Araceae
52.	*Portulaca oleracea* L.	Ghol	Portulacaceae
53.	*Prosopis juliflora* (Sw.) DC.	Vedi babhul	Mimosaceae
54.	*Scoparia dulcis* L.	Dulas	Scrophulariaceae
55.	*Solanum nigrum* L.	Kanguni	Solanaceae
56.	*Sonchus oleraceus* L.	Mhatara	Asteraceae
57.	*Spilanthes radicans* Jacq.	Akarkara	Asteraceae
58.	*Striga asiatica* (L.) Kuntze.	Piwla agya	Orobanchaceae
59.	*Synedrella nodiflora* (L.) Gaertn.	Cinderella Weed,	Asteraceae
60.	*Tephrosia purpuria* (L.) Pers.	Unhali	Fabaceae
61.	*Tribulus terrestris* L.	Sarata	Zygophyllaceae
62.	*Trichodesma indicum* L.	Chhota kalp, Pathari	Boraginaceae
63.	*Tridax procumbens* L.	Ekdandi, Kurmudi	Asteraceae
64.	*Typha angustata* Bory & Chaubard.	Pankanis	Typhaceae
65.	*Xanthium indicum* Koenig	Landaga	Asteraceae
66.	*Youngia japonica* (L.) DC.	Dudhani	Asteraceae

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Semester-IV	**Paper-I**
Course Code : BSC-BO401 T	**Title of Course :** Plant Anatomy and Embryology
Credits: 02	**Total lecture:** 30 Hours

Course outcomes:

On Completion of this Course students will be able to:

1) Understand the scope & importance of Anatomy and Embryology.
2) Know various tissue systems.
3) Understand the normal and anomalous secondary growth in plants and their causes.
4) Understand structure and development in microsporangium and megasporangium.
5) Understand microsporogenesis and megasporogenesis.
6) Understand male and female gametophytes.
7) Know fertilization, endosperm and embryogeny

Detailed syllabus:

Credit-I Plant anatomy: (15 Hours)

UNIT I. Introduction (2)

1.1 Definition
1.2 Scope of plant anatomy

UNIT II: Epidermal tissue system (3)

2.1 Structure, types and functions of epidermis
2.2 Structure, types and functions of Stomata
2.3 Epidermal outgrowths- non-glandular and glandular
2.4 Motor cells

UNIT III: Mechanical tissue system (2)

3.1 Principles involved in distribution of mechanical tissues with one example each
a) Inflexibility,
b) Incompressibility,
c) Inextensibility and
d) Shearing stress

UNIT IV: Vascular tissue system- **(2)**

Structure and function of xylem, phloem and cambium

UNIT V. Normal secondary growth **(3)**

5.1 Introduction, Concept of primary and secondary growth
5.2 Normal secondary growth in dicotyledonous stem
5.3 Development of annual rings, periderm, bark, tyloses and lenticel

UNIT VI. Anomalous secondary growth **(3)**

6.1 Introduction
6.2 Causes of anomalous secondary growth
6.3 Anomalous secondary growth in:
a) Dicotyledonous stem (*Bignonia*),
b) Dicotyledonous root (*Raphanus*),
c) Monocotyledonous stem (*Dracaena*)

Credit-II Plant Embryology **(15 Hours)**

UNIT I. Introduction **(1)**

1.1 Definition and scope of plant embryology

UNIT II: Microsporangium and male gametophyte **(4)**

2.1 Structure of tetrasporangiate anther
2.2 Types of tapetum
2.3 Sporogenous tissue
2.4 Microsporogenesis: process and its types
2.5 Types of microspore tetrad
2.6 Male gametophyte: structure and development of male gametophyte

UNIT III: Megasporangium and female gametophyte **(4)**

3.1 Structure
3.2 Types of ovules
3.3 Types of megaspore tetrads
3.4 Female gametophyte: structure of typical embryo sac
3.5 Types of embryo sacs – monosporic, bisporic and tetrasporic

UNIT IV: Pollination and Fertilization: **(3)**

4.1 Introduction and definition
4.2 Types of pollination
4.3 Germination of pollen grain
4.4 Entry of pollen tube- porogamy, mesogamy and chalazogamy
4.5 Double fertilization and its significance.

UNIT V: Endosperm and embryo **(3)**

5.1 Endosperm: Types – nuclear, helobial and cellular.
51.2 Structure of Dicotyledonous and Monocotyledonous embryo.

Suggested Readings:

1. Plant Anatomy, Chandurkar P J, Plant Anatomy Oxford and IBH publication Co. New Delhi 1971
2. B P Pandey, Plant Anatomy. S Chand and Co. Ltd, New Delhi 1978
3. Greulach V A and Adams J E Plant- An introduction to Modern Biology, Toppen Co. Ltd, Tokyo,
4. Eams and Mc Daniel,An Introduction to Plant Anatomy, McGraw –Hill Book Co. Ltd and Kogakusha Co, Tokyo, Japan
5. Adriance S Foster Practical Plant Anatomy, D Van Nostrand Co. INC, New York
6. Esau, Plant Anatomy, Wiley Toppan Co. California, USA
7. Pijush Roy, Plant Anatomy. New Central Book Agency Ltd, Kolkata
8. Pandey S N and Ajanta Chadha, Plant Anatomy and Embryology,Vikas Publishing House,Pvt, Ltd, New Delhi
9. Bhojwani S S and Bhatnagar S P, An Embryology of Angiosperms
10. Maheshwari P, An introduction to Embryology of Angiosperm
11. Nair P K K Essentials of Palynology.
12. Fahn A. Plant Anatomy**,** Pergamon Press, Long Island City, New York, 1967

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Semester-IV	**Paper-II**
Course Code : BSC-BO402 T	**Title of Course :** Plant Biotechnology
Credits: 02	**Total lecture:** 30 Hours

Course outcomes:

After successful completion of this course, students will be able to:

1) Know about Equipment's required in Tissue Culture Lab
2) Media preparation techniques for different plants
3) Sterilization techniques for media as well as for explants
4) Understand basic principles and modern age applications of recombinant DNA technology
5) Students able to understand concept and applications of Genomics, Proteomics and Bioinformatics.
6) Know the various sources for bioethanol /biodiesel production.

Detailed syllabus:

Credit I: **(15 Hours)**

UNIT I: Introduction to Plant Biotechnology **(3)**

1.1 History and definition
1.2 Scope and importance of plant biotechnology
1.3 Current status of biotechnology in India.

UNIT II: Plant Tissue Culture **(8)**

2.1 Concept of plant tissue culture and cellular totipotency
2.2 Basic techniques: Types of culture, Media preparation, sterilization, inoculation, incubation, hardening
2.3 Applications with reference to: Micropropagation, Somaclonal variation, Haploid production, Protoplast fusion & Somatic hybrids, Embryo rescue, Production of secondary metabolites.
2.4 Commercial Plant Tissue culture laboratories in Maharashtra and India.

UNIT III: Single Cell Protein (SCP) **(4)**

3.1 Concept and definition
3.2 Importance of proteins in diet
3.3 Production of SCP from *Spirulina* and Yeast
3.4 Importance & acceptability of SCP

Credit II:

UNIT I: Plant Genetic Engineering **(5)**

1.1 Introduction, concept
1.2 Tools of genetic engineering (plasmid vectors, restriction enzymes, ligases,)
1.3 Gene cloning Technique
1.4 Applications of plant genetic engineering: insect pest resistance, abiotic stress tolerance, herbicide resistance

UNIT II: Genomics, Proteomics and Bioinformatics **(5)**

2.1 Genomics- concept, types, methods used for whole genome sequencing
2.2 Proteomics-concept, types, methods used in proteome analysis
2.3 Bioinformatics-concept, database and its classification, data retrieval tools.

UNIT III: Bioremediation **(2)**

3.1 Introduction and concept
3.2 Microbial remediation
3.3 Phytoremediation

UNIT IV: Biofuel technology **(3)**

4.1 Definition, Concept and types of Renewable and nonrenewable energy sources
4.2 Definition and concept of Biogas, Bioethanol, Biobutanol, Biodiesel & Biohydrogen

Suggested Readings:

1. B.D. Singh (4thEdn 2012) Biotechnology-expanding horizons, Kalyani Publishers.
2. K.S. Bilgrami& A.K. Pandey (2007) Introduction to Biotechnology CBS Publishers and Distributors PVT LTD
3. M.K. Razdan (2002) Introduction to Plant Tissue Culture. Oxford and IBH Publishing Co., New Delhi.
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8. Shantharam, S. and Montgomery, J.F. 1999. Biotechnology, Biosafety and Biodiversity. Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi.
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Ahmednagar Jilha Maratha Vidya Prasarak Samaj's

New Arts, Commerce and Science College, Ahmednagar (Autonomous)

Syllabus of S. Y. B. Sc. Botany
under
Faculty of Science

Semester-IV	**Paper-III**
Course Code : BSC-BO403 P	**Title of Course :** Practicals based on BO 401 and BO 402
Credits: 02	**Total lecture:** 30 Hours

Practicals:

Plant Anatomy and Embryology

1. Study of epidermal tissue system – non-glandular and glandular trichomes, multilayered epidermis, typical stomata (Dicotyledonous and Monocotyledonous). **(2P)**
2. Study of mechanical tissues and their distribution in root, stem and leaves. **(1P)**
3. Study of normal secondary growth in dicot stem – *Annona* and *Moringa* (Double stained temporary preparation). **(1P)**
4. Study of anomalous secondary growth in *Bignonia* and *Dracaena* stem (Double stained temporary preparation). **(1P)**
5. Study of tetrasporangiate anther and types of ovules with the help of permanent slides **(1P)**
6. Study of dicot and monocot embryo. **(1P)**

Plant Biotechnology

1. Instruments/equipments used in plant tissue culture laboratory: Principle and working of Autoclave, oven, laminar air flow cabinet, micropipette, culture bottles/tubes with cotton plug. **(1P)**
2. Preparation and sterilization of MS medium. **(1P)**
3. Surface sterilization and Inoculation of nodal sector/ leaf/ anther and maize embryo. **(2P)**
4. Laboratory cultivation of *Spirulina* **(1P)**
5. Demonstration practical on transgenic crops viz; Bt-Cotton, Golden rice **(1P)**
6. Demonstration of principle and working of agarose gel electrophoresis, centrifuge, spectrophotometer **(1P)**
7. Visit to plant tissue culture laboratory/ Research institute **(1P)**