MANONMANIAM SUNDARANAR UNIVERSITY,
TIRUNELVELI-12

SYLLABUS

UG - COURSES – AFFILIATED COLLEGES

Course Structure for B. Sc. Botany
(Choice Based Credit System)
(with effect from the academic year 2023-2024 onwards)

Semester-V				
Part	**Subject Status**	**Subject Title**	**Subject Code**	**Credit**
III	CORE	PLANT MORPHOLOGY, TAXONOMY AND ECONOMIC BOTANY		4
III	CORE	CELL BIOLOGY, PLANT ANATOMY AND EMBRYOLOGY		4
III	CORE	PLANT MORPHOLOGY, TAXONOMY AND ECONOMIC BOTANY – PRACTICAL V		2
III	CORE	CELL BIOLOGY, PLANT ANATOMY AND EMBRYOLOGY – PRACTICAL VI		2
III	CORE	PROJECT WITH VIVA-VOCE		3
III	ELECTIVE	**BIO-ANALYTICAL TECHNIQUES**/ AQUATIC BOTANY/ ENTREPRENEURIAL BOTANY		3
III	ELECTIVE	**PLANT BIORESOURCES**/ SEED BIOLOGY/ POMOLOGY		3
IV	NAAN MUDHALVAN	FLORICULTURE		2
V		INTERNSHIP / INDUSTRIAL TRAINING / FIELD WORK / KNOWLEDGE UPDATION ACTIVITY		2

Total Marks: 100 Internal Exam: 25 marks + External Exam: 75 marks

A. **Scheme for internal Assessment**:
Maximum marks for written test: **20 marks**
3 internal tests, each of **I hour** duration shall be conducted every semester.
To the average of the **best two** written examinations must be added the marks scored in. The **assignment** for 5 marks.

The break up for internal assessment shall be:
Written test- 20 marks; Assignment -5 marks Total - 25 marks

B. Scheme of External Examination
3 hrs. examination at the end of the semester
A – Part : 1 mark question two - from each unit
B – Part : 5 marks question one - from each unit
C – Part : 8 marks question one - from each unit

- **Conversion of Marks into Grade Points and Letter Grades**

S.No	Marks	Letter Grade	Grade point (GP)	Performance
1	90-100	O	10	Outstanding
2	80-89	A+	9	Excellent
3	70-79	A	8	Very Good
4	60-69	B+	7	Good
5	50-59	B	6	Above Average
6	40-49	C	5	Pass
7	0-39	RA	-	Reappear
8	0	AA	-	Absent

- **Cumulative Grade Point Average (CGPA)**

$$\mathbf{CGPA} = \frac{\mathbf{\Sigma\,(GP \times C)}}{\mathbf{\Sigma C}}$$

- **GP** = Grade point, **C** = Credit
- CGPA is calculated only for Part-III courses
- CGPA for a semester is awarded on cumulative basis

- **Classification**
  a) First Class with Distinction : CGPA $\geq$ 7.5*****
  b) First Class : CGPA $\geq$ 6.0
  c) Second Class : CGPA $\geq$ 5.0 and $<$ 6.0
  d) Third Class : CGPA$<$ 5.0

PLANT MORPHOLOGY, TAXONOMY AND ECONOMIC BOTANY

Learning Objectives

- To provide knowledge on the morphology (vegetative structures and floral structures) of flowering plants.
- To enable the Students to know about the systems of classification of plants.
- To know the characteristic features of the selected families.
- To know and identify the key floral characteristics of the selected families
- To know the economic importance of plants.

UNIT I

Morphology Morphology– root system – tap root,modifications. Shoot system – underground modifications. Leaf-Types-simple and compound- phyllotaxy, modifications-phylloclade, phyllode, tendrils, stipules. Inflorescences — racemose, cymose, and special types. Fruits – classification (outline only).

UNIT II

Taxonomy

Systems of Angiosperm classification – Artificial, Natural and Phylogenetic. An outline of Bentham and Hooker system of classification, and Engler &Prantle Classification.Botanical nomenclature–rules, typification and author citation. Herbarium technique–collection, pressing, drying, mounting and preservation of plant specimens.

UNIT III

Study of the following families based on the Natural system and their economic importance: Annonaceae, Nymphaeaceae, Rutaceae, Caesalpinaceae, Cucurbitaceae, Apocynaceae and Asclepiadaceae.

UNIT IV

Study of the following families based on the natural system and their economic importance: Convolvulaceae, Acanthaceae, Lamiaceae, Euphorbiaceae, Liliaceae, Arecaceae and Poaceae.

UNIT V

Economic Botany Economic importance of families prescribed in the syllabus with reference to: fruits, vegetables, cereals, spices, oils, timber, dye, medicine

Recommended Texts

1. Lawrence, G.H.M. 1985. An Introduction to Plant Taxonomy, Central Book Depot, Allahabad.
2. Porter, C.L. 1982. Taxonomy of Flowering Plants, Eurasia Publications House,

New Delhi
3. Solbrig, O.T. 1970. Principles and Methods of Plant Biosystematics. The MacMillan Co-collier-MacMillan Ltd., London.
4. Solbrig, O.T and Solbrig, D.J. 1979. Population Biology and Evolution, Addison Weslley Publicating Co. Ind USA.
5. Takhtajan, A.L. 1997. Diversity and Classification of Flowering Plants. Columbia University Press, New York.
6. Woodland, D.W. 1991. Contemporary Plant Systematics. Prentice Hall. New Jersey.
7. Rajni Gupta. 2012. Plant Taxonomy: Past, Present and Future. Vedams (P) Ltd. New Delhi.

Reference Books

1. Hutchinson, J. 1973. The Families of Flowering plants, Oxford University press, London.
2. Gamble, J.S., Fisher, L.E.F.1967. The Flora of The presidency of Madras (Vol-III) BSI, Calcutta
3. Davis, P.H and Heywood, V.M. 1965. Principles of Angiosperm Taxonomy, Oliver and Boyd Edinburgh.
4. Clive AS.1989. Plant Taxonomy and Biosystematics, Chapman and Hall Inc. New York.
5. Harborne, J.B and Turner, B.L. 1984. Plant Chemosystematics, Acad. Press, London.
6. Lawrence, G.H. 1955. Taxonomy of Vascular Plants, MacMillan Co., USA.
7. Jones, S.B. Jr. and Luchsinger, A.E. 1986. Plant Systematics (2nd edition). McGraw HilI Book Co., New York.

Web Resources

1. https://books.google.co.in/books/about/Plant_Taxonomy_2E.html?id=_px_WAwHiZIC&redirhttps://books.google.co.in/books/about/Plant_Taxonomy_and_Biosystematics.html?id=VfQnuwh3bw8C&redir_esc=y_esc=y
2. https://books.google.co.in/books/about/PLANT_TAXONOMY_2E.html?id=Roi0lwSXFnUC&redir_esc=y
3. https://books.google.co.in/books/about/Plant_Taxonomy.html?id=0bYs8F0Mb9gC&redir_esc=y
4. https://books.google.co.in/books/about/Economic_Botany.html?id=2ahsDQAAQBAJ&redir_esc=y
5. https://books.google.co.in/books/about/Textbook_Of_Economic_Botany.html?id=XmZFJO_JHv8C&redir_esc=y

CELL BIOLOGY, PLANT ANATOMY AND EMBRYOLOGY

Learning Objectives

- To Distinguish between prokaryotic and eukaryotic cells.
- To know fundamental concepts of structure and function of cell organelles
- To understandthe internal tissue organization of various plant organs.
- To familiarize with normal and anomalous secondary growth in plants
- To comprehend the structural organization of reproductive organs with relevance to the process of pollination and fertilization

UNIT I
CELL BIOLOGY

Ultra structure of Prokaryotic cell and Eukaryotic cell. Cell wall- Structure, and functions of cell wall, Plasma membrane - structure (fluid mosaic model) and function. Cell cycle, Cell division, Mitosis and Meiosis- their significance

UNIT II

Structure and function of Endoplasmic reticulum, Ribosomes, Mitochondria, Chloroplast, Nucleus, and Chromosomes. Cell inclusions – starch grains, crystals - cystolyth and raphide.

UNIT III
ANATOMY

Tissues - Definition, types - Simple tissue system - parenchyma, collenchyma and sclerenchyma (fibers and sclereids). Complex tissue system - xylem and phloem. Meristem: definition, structure, function,. Apical organization and theories: Tunica-Corpus theory. Root apex: Histogen theory .

UNIT IV

Primary structure of root and stem (Dicot and monocot). Secondary thickening in dicot root and stem. Anomalous secondary growth of stem- Boerhaavia, and Dracaena.

UNIT V
EMBRYOLOGY

Structure of mature anther and ovule, types of ovules. Female gametophyte– megasporogenesis (monosporic, bisporic and tetrasporic) and megagametogenesis (Polygonum type in detail); Double fertilization and triple fusion. Endosperm and its types - free nuclear, cellular, helobial. Endosperm haustoria

Recommended Texts

1. Bhojwani, S.S and Bhatnagar, S.P. 1994. Embryology of Angiosperms, Vikas.
2. Bhojwani, S.S and Bhatnagar, S.P. 2000. The Embryology of Angiosperms (4th revised and enlarged edition). Vikas Publishing House, New Delhi.
3. Burgess, J. 1985. An Introduction to Plant Cell Development. Cambridge University Press, Cambridge.
4. Raghavan, V. 1999. Developmental Biology of Flowering Plants. Springer-Verlag, New York. 5. Vimla Singh and Alok Abhishek. 2019. Plant Embryology and Experimental Biology. Educational Publishers and Distributors. New Delhi.
5. Pandey, B.P.2015. Plant Anatomy S. Chand Publ. New Delhi.
6. Bhatnagar,S.P., Dantu, P.K, Bhojwani, S.S. 2014. The Embryology of Angiosperms 6th edition Vikas Publishing House. Delhi.
7. Waisel, Y., Eshel, A and Kafkaki, U. (eds.). 1996. Plant Roots : The Hidden Hall (2nd edition). Marcel Dekker, New York.

Reference Books

1. Esau, K. 1985. Anatomy of Seed Plants –John Willey.
2. Cutter, E.G. 1989. Plant Anatomy – Part I – Addison – Wesley Publishing Co..
3. Maheswari, P.1991. An Introduction to Embryology of Angiosperms, Tata McGraw Hill Publishing Co. Ltd.,
4. Swamy, B.G.L and Krishnamoorthy. K.V.1990. From Flower to Fruits, Tata McGraw Hill Publishing Co. Ltd.
5. Dickison, W.C. 2000. Integrative Plant Anatomy. Harcourt Academic Press, USA.
6. Fahn, A. 1974. Plant Anatomy. Pergmon Press, USA.
7. Mauseth, J.D. 1988. Plant Anatomy. The Benjammin/Cummings Publisher, USA.
8. Evert, R.F. 2006. Esau‘s Plant Anatomy: Meristems, Cells, and Tissues of the Plant Body: Their Structure, Function and Development. John Wiley and Sons, Inc. Any local/state/regional flora published by BSI or any other agency.
9. Swamy, B.G.L and Krishnamurthy, K.V.1980. From flower to fruit .Tata McGraw Hill Co. Pvt. Ltd, New Delhi

Web Resources

1. https://www.amazon.in/PLANT-ANATOMYEMBRYOLOGY BIOTECHNOLOGYebook/dp/B07H5JYFBJ/ref=asc_df_B07H5JYFBJ/?tag=google hopdes-2
2. https://www.kobo.com/us/en/ebook/a-textbook-of-plant-anatomy
3. https://archive.org/EXPERIMENTS/plantanatomy031773mbp
4. https://www.amazon.in/Embryology-Angiosperms-6th-S-P-Bhatnagar-ebook/dp/B00UN5KPQG
5. https://www.worldcat.org/title/embryology-of-angiosperms/oclc/742342811
6. https://books.google.co.in/books/about/Embryology_of_angiosperms.html?id=uYfwAAAAMAAJ&redir_esc=y.

PLANT MORPHOLOGY, TAXONOMY AND ECONOMIC BOTANY-PRACTICAL-V

Learning Objectives

- To study morphology of plant parts
- To enable the students to describe the plant technically using the floral characteristics.
- To preserve the plants and prepare herbarium sheets.
- To understand the economic importance of flowering plants
- To be able to identify the local flora.

PRACTICALS

1. Morphology of root, stem and leaf modification, types of inflorescence as mentioned in the theory.
2. Dissection, identification, observation of the floral parts of the plants belonging to the families included in the syllabus.
3. Preparation and submission of ten Herbarium sheets and field notebook
4. Study the products of plants mentioned in the syllabus of economic botany with special reference to the morphology, botanical name and family.
5. Field trips to places for observation, study and collection of plants prescribed in the syllabus for 2 to 3 days under the guidance of faculties

Recommended Texts

1. Subramaniam, N.S. 1996. Laboratory Manual of Plant Taxonomy. Vikas Publishing House Pvt. Ltd., New Delhi.
2. Gokhale, S.B., Kokate, C.K. and Gokhale, A. 2016. Pharmacognosy of Traditional Drugs. Nirali Prakashan, 1st Edition. ISBN: 9351642062.
3. Rendle, A.B. 1980. The Classification of Flowering Plants (Vol. I & II), Vikas Students Education.
4. Pandely, B.P. 1987. Taxonomy of Angiosperms.
5. Nordenstam, B., EI Gazaly, G and Kassas, M. 2000. Plant Systematics for 21st Century. Portlant Press Ltd., London.

Reference Books

1. Mann J. Davidson, R.S and J.B. Hobbs, D.V.Banthorpe, J.B.Harborne. 1994. Natural Products. Longman Scientific and Technical Essex.
2. Gopalan, C., B.V.Ramasastri and S.C. Balasubramanian. 1985 .Nutritive Value of Indian Foods. Nationa lInstitute of Nutrition, Hyderabad.
3. Grant, W.E. 1984. Plant Biosystematics. Academic Press, London.
4. Harrison, H.J. 1971. New Concepts in Flowering Plant Taxonomy. Rieman Educational Book Ltd., London.
5. Jones, A.D. and Wilbins, A.D. 1971. Variations and Adaptations in Plant Species. Hiemand & Co. Educational Books Ltd. London.

Web resources

1. https://www.amazon.in/Practical-Taxonomy-Angiosperms-R-Sinha/dp/9380578210
2. https://www.wileyindia.com/plant-science/practical-taxonomy-of-angiosperms-2ed.html
3. https://www.flipkart.com/practical-taxonomy-angiosperms/p/itm194794e7a76e8
4. https://books.google.co.in/books/about/Plant_Taxonomy.html?id=uWg76rCqA68C
5. https://www.amazon.in/PLANT-TAXONOMY-Sharma/dp/0070141592
6. https://www.kopykitab.com/Economic-Botany-By-Manoj-Kumar-Sharma-eBook.

CELL BIOLOGY, PLANT ANATOMY AND EMBRYOLOGY PRACTICAL-VI

Learning Objectives

- To study the cell structure and cell organelles
- To learn about cell inclusions and methods of cell division..
- To identify the structure of plant tissues.
- To understand about normal and anomalous secondary growth
- To recognize the structure of anther, ovule and learn the skill of embryo dissection

PRACTICALS

Cell Biology

1. Study of photo micrographs of cell organelles mentioned in the theory.
2. Observation of cell inclusions through permanent slides -starch grains, , crystals - cystolyth and raphide.
3. Identification of different stages of mitosis by using squash and smear techniques (acetocarmine) – onion root tip.

Anatomy

4. Observation of Simple and complex (Primary and Secondary) tissues.through permanent slides.
5. Observation of Meristems – Shoot apex and Root apex through permanent slides
6. Sectioning: Internal structure of young root and stem of dicot and monocot plant.
7. Sectioning: Secondary structure of dicot and monocot root.
8. Sectioning of Anomalous secondary growth in the stems of Boerhaavia, and Dracaena.

Embryology

9. Sectioning mature anther- Datura

10. Types of ovules- Anatropous, Orthotropous, Circinotropous, Amphitropous, Campylotropous (Permanent slides).
11. Types of Endosperm - Nuclear, cellular and helobial(photograph)
12. Dissection and display of anyone stage of embryo in Tridax.

Recommended Texts

1. Sundara, R. S. 2000. Practical manual of plant anatomy and embryology. Anmol Publ. PVT LTD, New Delhi.
2. Panshin, A.J and C. de Zeeuw.1980.Textbook of wood technology. Structure, identification and uses of the commercial woods of the United States and Canada. Fourth Edition. New York: McGraw-Hill Book Company.
3. Sharma, H.P. 2009. Plant Embryology: Classical and Experimental, Bombay Popular Prakashan, ISBN-8173199698, 9788173199691.
4. Gupta P.K. 2017. Cell and Molecular Biology (5th ed.), Rastogi Publications, Meerut.
5. Krebs J.E., Goldstein E.S and Kilpatrick S.T. 2017. Lewin's GENES XII (12thed.). Jones & Bartlett Learning.
6. Jackson, S.A., Kianian, S.F., Hossain, K.G and Walling, J.G. 2012. Practical laboratory exercises for plant molecular cytogenetics. In Plant Cytogenetics (pp. 323 333). Springer, New York.

Reference Books

1. Sundara Rajan, S, 2003. Practical Manual of Plant Anatomy and Embryology 1st ed, Anmol Publications, ISBN-812610668.
2. Katherine Esau. 2006. Anatomy of Seed Plants. 2nd edition, John Wiley and Sons.
3. Allen, Sarah et al., 2016. Plant Anatomy Lab Manual, Fall.
4. Gardener, J, Simmons, H.J and Snustad, D.P. 2006. Principle of Genetics, John Wiley & Sons, New York.
5. De Robertis E.D.P. and De Robertis E.M.P. 2017. Cell and Molecular Biology (8thed.) (South Asian Edition), Lea and Febiger, Philadelphia, USA.
6. Jackson, S.A., Kianian, S.F., Hossain, K.G., and Walling, J. G. 2012. Practical laboratory exercises for plant molecular cytogenetics. In Plant Cytogenetics (pp. 323-333). Springer, New York, NY.

Web resources

1. https://www.amazon.in/Practical-Anatomy-Adriance-1901-1973Foster/dp/1341784509
2. https://books.google.co.in/books/about/Practical_Manual_Of_Plant_Anatomy_And_Em.html?id =Cq1KPwAACAAJ&redir_esc=y
3. https://www.amazon.in/Cell-Biology-Dr-Renu-Gupta/dp/8193651219
4. https://www.amazon.in/Practical-Handbook-Genetics-VikasPali/dp/932727248X
5. https://www.amazon.in/Practical-Handbook-Plant-Breeding-Vikas/dp/9327272498

PROJECT WITH VIVA-VOCE - GROUP PROJECT

Learning Objectives

- To recognize the concept of research and its various forms in the context of botany.
- To improve abilities relating to scientific experiments.
- To become proficient in data collection and the documentation of scientific findings.
- To prepare students for entry-level positions or professional training programmes in any field of Botany.
- Compare the various reporting and writing styles used in science.

UNIT I

1. Each student will be allotted a Project Guide from the faculty of the department concerned by lot method.
2. The topic of the dissertation shall be assigned to the candidate before the beginning of third semester.
3. After the completion of the project work, the student has to submit four copies of dissertation with report carrying his/her project report for evaluation by examiners. After evaluation, one copy is to be retained in the College Library.
4. Project work will be evaluated by both the external and the internal (Project Guide) examiners for the maximum of 100marks in total on the scale of the maximum of 50marksforthe internal and the external each.

Viva-voce will be conducted by the panel comprising, External examiner and Internal Examiner for the maximum of 100 marks in total on the scale of the maximum of 50marksforthe internal and the external each.

UNIT II

1. Dissertation/Thesis based on the work done by the student.
2. Soft copy of the project on CD/DVD.

PROJECT EVALUATION GUIDELINES:

The project is evaluated on the basis of following heads:

For Viva-Voce maximum is 60 marks which will be conducted by both the internal and external examiners during end semester university practical examinations.

Internal: 40 marks

I Review – Selection of the field of study, topic and literature collection - 15 marks
II Review – Research design and data collection - 10 marks
III Review – Analysis and conclusion, preparation of rough draft - 15 marks

External: 60 marks

Thesis/ Dissertation - 30 marks
Presentation - 15 marks
Viva-voce - 15 marks

UNIT III

Suggested areas of work: Algae, fungi, microbiology, biocontrol agents, plant tissue culture, plant physiology, phytochemistry, biochemistry, anatomy, plant taxonomy,

Ethnobotany, ecology, sustainable agriculture, herbal formulations, cytogenetics, molecular biology, biotechnology, bioinformatics, nanotechnology and applied botany.

UNIT IV

Methodology:

Each project should contain the following details:

1. Brief introduction on the topic
2. Review of Literature
3. Materials and Methods
4. Results and Discussion – evidences in the form of figures, tables and photographs.
5. Summary
6. Bibliography

Recommended Texts:

1. Wilson, K and J.Walker (Eds). 1994. Principles and Techniques of Practical Biochemistry (4th Edition) Cambridge University Press, Cambridge.
2. Bendre, A.M and Ashok Kumar. 2009. A textbook of practical Botany. Vol.I & II. Rastogi Publication. Meerut. 9th Edition.
3. Manju Bala, Sunita Gupta, Gupta, N.K. 2012. Practicals in Plant Physiology and Biochemistry. Scientific Publisher.
4. Wilson, K and J.Walker. 2005. Principles and Techniques of Practical Biochemistry, 5th Edition. Cambridge University press, NewYork.
5. Rodney Boyer. 2000. Modern Experimental Biochemistry, 3rd Edition. Published by Addison Wesley Longman. Singapore.

Reference Books:

1. Dawson, C. 2002. Practical research methods. UBS Publishers, New Delhi.
2. Stapleton, P., Yondeowei, A., Mukanyange, J., Houten, H. 1995. Scientific writing for agricultural research scientists – a training reference manual. West Africa Rice Development Association, Hong Kong.
3. Ruzin, S.E. 1999. Plant microtechnique and microscopy. Oxford University Press, New York, U.S.A.
4. Wilson and Goulding. 1987. Principles of biochemical techniques, Oxford University Press.
5. Mukherji, S. and Ghosh, A.K. 2005. Plant Physiology. First Central Edition, New Central Book Agency (P) Ltd., Kolkata.
6. Taiz, L and Zeiger, E. 2010. Plant Physiology. 5th Edition. Sinauer Associates, USA.
7. Heldt, H.W and Piechulla, B. 2010. Plant Biochemistry, 4th Edition. Academic Press, NY.
8. Wilson, K and Walker, J. 2010. Principles and Techniques of Biochemistry and Molecular Biology, Seventh edition, Cambridge University Press, USA.

Web resources:

1. https://handbook.monash.edu › units › BIO3011
2. https://www.amazon.in/Practical-Manual-on-Plant-Biochemistry/dp/6200539790
3. https://www.amazon.in/Laboratory-Manual-Physiology-Mukesh-Amaregouda/dp/6133993502
4. https://www.kopykitab.com/A-Laboratory-Manual-of-Plant-Physiology-Biochemistry-and-Ecology-by-Akhtar-Inam
5. https://kau.in/document/laboratory-manual-biochemistry

BIO-ANALYTICAL TECHNIQUES

Learning Objectives

- To understand the principle, operation of micrscopes
- To know the principle and application of chromatographic techniques
- To equip students with understanding on pH metry and gel electrophoresis
- To provide an overview of spectrophotometry and centrifugation techniques
- To give an exposure to application of statistics in biological research

UNIT I

MICROSCOPY: Principles and structure of microscopy; Light microscopy; Fluorescent, Transmission and Scanning electron microscopy. Microscopic measurements-micrometry- Stage and ocular micrometer

UNIT II

CHROMATOGRAPHY: Principle and applications: Paper chromatography, Thin Layer Chromatography (TLC), Column chromatography, Gas chromatography – Mass spectrometry (GCMS)

UNIT III

ELECTROPHORESIS ANDPH METER: Basic principle, construction and operation and applications of pH meter. Polyacrylamide gel electrophoresis (PAGE), Agarose Gel Electrophoresis.

UNIT IV

SPECTROPHOTOMETRY AND CENTRIFUGATION TECHNIQUE: Principle and law of absorption, construction, Operation and uses of colorimeter and UV–Visible spectrophotometer. Principles, methods of centrifugation, types of centrifuge and applications.

UNIT V

BIOSTATISTICS: Collection and interpretation of data, sampling; Representation of Data: Tabular, Graphical– Histogram, frequency curve, Bar diagram. Measures of central tendency – Mean, Median and Mode; Standard deviation, Standard error, Chi-square test and goodness of fit –t test.

Recommended Texts

1. Sharma, V.K. 1991. Techniques in microscopy and cell biology, Tata McGraw Hill, New Delhi.
2. Sawhney, S.K and Randhir Singh. 2000. Introductory practical biochemistry, Narosa Publishing House.
3. Asokan, P. 2001. Basics of analytical biochemistry. Chinna Publications.
4. Bajpai, P.K. 2006. Biological instrumentation and methodology. S. Chand & Company, New Delhi.
5. Veerakumari, L. 2009. Bioinstrumentation. MJP Publications.

6. Palanivelu, P. 2013. Analytical Biochemistry and Separation techniques, 20th century publications, Palkalai nagar, Madurai.

Reference Books

1. Rana, S.V.S. 2009. Biotechniques: Theory and Practice. Rastogi Publications.
2. Zar, J.H. 2012. Biostatistical Analysis. 4th edition. Pearson Publication. U.S.A.
3. Sundar Rao, P.S.S and Richard, J. 2011. Introduction to Biostatistics and research methods, PHI learning Private Ltd., New Delhi.
4. Johansen, D.A. 1940. Plant Micro technique, TATA McGraw Hill Book Co., Ins., New Delhi.
5. Peter Gray. 1964. Handbook of Basic Micro technique. McGraw hill publication, New York.
6. Cooper, T.G. 1991. The Tools of Bio - chemistry, John Wiley & sons, London.
7. Dey, P.M and Harborne, J.B. 2000. Plant Biochemistry Harcourt Asia Pvt. Ltd.
8. Plummer, D.T. 2003. An introduction to practical Biochemistry. 3rd Edn. Tata McGraw Hill Publishing Company Ltd. New Delhi.
9. Zar, J.H. 1984. Biostatistics Analysis, Prentice Hall International, England Cliffs, New Jersy.

Web Resources

1. https://www.kobo.com/in/en/ebook/bioinstrumentation-1
2. https://www.worldcat.org/title/bioinstrumentation/oclc/74848857
3. https://www.amazon.in/Bioinstrumentation-M-H-Fulekar-Bhawana-Pandey-ebook/dp/B01JP3M9TW
4. https://www.amazon.in/Handbook-Biomedical-Instrumentation-R-S-Khandpur-ebook/dp/B0129ZDO9W?ref=kindlecontentin50-21&tag=kindlecontentin50-21&gclid=CjwKCAiAx_DwBRAfEiwA3vwZYkqkwRb_EGf73exaWpY8D9JNpJZsOcXQCQ4pZlRzTrYH2lopaVP1xxoClPgQAvD_BwE
5. https://www.kobo.com/us/en/ebooks/biostatistics
6. https://www.amazon.in/Biostatistics-Veer-Bala-Rastogi-ebook/dp/B07LDCPXDG

PLANT BIORESOURCES

Learning Objectives

- To know the existing usages of various plant Bioresources
- Gain knowledge on various production process & applications of the plant Bioresources
- Encourage research and enterpreuner ideas about plant Bioresources & its utilization in different fields.

UNIT I

AGRICULTURE USES OF ALGAE: Algae- Role of algae in soil fertility, green manure, nitrogen fixation,. Medicinal uses, biofuels, research tools. Algae as pollution indicators, water blooms, eutrophication, and parasitic algae.

UNIT II

INDUSTRIAL USES OF ALGAE: Role of algae as food and fodder. Commercial

products- Agar- Agar, Carrageenan, Alginic acid, diatomite and their uses in various industries. Algae and space travel. Methods of cultivation of seaweeds.

UNIT III

INDUSTRIAL USES OF MICROBES Fungi and bacteria: Role in medicine, food, industrial uses –alcohol, enzyme, organic acid, hormones, cheese, proteins, vitamins, antibiotics, probiotics. Harmful effects of fungi on man and plants (outline only).

UNIT IV

ORGANIC FARMING & BIO-REMEDIATIONS: Organic farming- definition and basic concepts, farm manures, mulches, mycorhizal association, types.VAM and its uses. Recycling of biodegradable municipal, agricultural and industrial wastes, bio composting.

UNIT V

USES OF CRYPTOGAMS AND GYMNOSPERMS: Selection of an enterprise, business planning, mobilization of resources, project proposal (guidelines, collection of information and preparation of project report), steps in filing patents, trademarks and copyright, Intellectual Property Rights, export and import license.

Recommended Texts

1. Vashishta, B.R., Sinha, A.K. and Singh, V.P. 2008. Botany for Degree Students: Algae. S. Chand & Company Ltd., New Delhi.
2. Vashishta, B.R. 1990. Botany for Degree Students: Fungi. S. Chand & Company Ltd., New Delhi.
3. Vashista, P.C. 1997. Botany for Degree StudentsPteridophyta. S. Chand and Company Ltd., New Delhi.
4. Vashishta, P.C. 1996. Botany for Degree Students-Gymnosperms (2nd Edn.,). S. Chand and Company Ltd., New Delhi.
5. Pandey, B.P. 2001. College Botany Vol. I: Algae, Fungi, Lichens, Bacteria, Viruses, Plant Pathology, Industrial Microbiology and Bryophyta. S. Chand & Company Ltd., New Delhi.

Reference Books

1. Kumar, H.D. 1999. Introductory Phycology (2nd edition). Affiliated EastWest Press Pvt. Ltd. Delhi.
2. Sharma OP. 1989. Text Book of fungi. Tata McGraw Hill, New York.
3. Hale, 1996. The biology of Lichens, New Age International Publishers, New Delhi.
4. Smith, G.M. 1955. Cryptogamic Botany Vol. II Bryophytes and Pteridophytes (2nd edn.). Tata McGraw Hill Publishing Co., New Delhi.
5. Pandey. 1998. A Text Book of Botany Vol. II. S. Chand & Co. Ltd. 1980.
6. Palaniappan, S.P and K. Annadurai. 2018. Organic farming theory and practice, Scientific Publishers Jodhpur, India.

Web resources

1. https://www.mooc-list.com/course/introduction-algae-coursera
2. https://swayam.gov.in/nd2_cec20_bt11/preview
3. https://www.brainkart.com/article/Economic-importance-Plants---Food,-Rice,Oil,-Fibre,-Timber-yielding-plant_1095/
4. https://onlinelibrary.wiley.com/doi/book/10.1002/97811184605665.

ACADEMIC-INDUSTRIAL ACTIVITY

- The main goal of the internship programme is to give students exposure to industry and help them comprehend current management techniques by having them work for at least fifteen days in an industry/institution over the summer..
- To comprehend how theoretical ideas are applied in many sectors and industries.
- To create a foundation for industry-integrated education, as well as to give students better practical knowledge and hands-on experience, improve their leadership qualities, and sharpen their problem-solving and management skills.
- The internship must focus on practice. The college will require the students to visit the offices of the research lab/industry/institution it has a memorandum of understanding (MOU) with in order to receive on-the-job training in the many different areas of those businesses' operations.
- Internships provide students with practical experience in a variety of fields, including manufacturing, productivity, development, and quality analysis. These experiences prepare students for competitive hiring processes in reputable MNC industries.

UNIT I

Guidelines for Internship Programme:

1. To give students the opportunity to spend at least fifteen days on their own during the II Semester vocation in order to acquire exposure to research labs, industry, and respected institutions and comprehend contemporary research procedures.
2. Individual instruction is provided for the internship. The internship programme must be completed in order to receive a credential.
3. Students are required to indentify a research labs/industry/recognized institution for their Internship Programme Coordinator in consultation with and approval of their faculty guide. The choice of the research labs/industry/recognized institution should be intimated to the Internship coordinator before commencement of the Internship. Simultaneously, students should also have identified a guide within the research labs/industry/recognized

institution (industry guide) under whose supervision and guidance they would carry out their Internship Program.

4. Students are expected to learn about the history of the research labs, industry, and recognized institution during their time. They must also learn about its founders or shareholders, the nature of business, organizational structure, reporting relationships, and how the various management functions (such as finance, HR, marketing, sales, and operations) operate. This list is merely illustrative and not comprehensive. Students should collect and gather as much as possible of written materials, published data, and related matter.
5. Before leaving the research labs/industry/recognized institution, obtain the Internship Programme completion certificate on the letterhead of a research lab/industry/, or an accredited institution.
6. Maintain Internship Programme record with details on activities and personal learning during their project period.
7. The department head and the coordinator of the internship programme form a committee to ensure that the internship is followed.
8. At least two copies of the report must be prepared by the intern at the conclusion of the internship program—one for submission to the college and one copy for the student. If the organization, the guide, or both request additional copies, more copies may be made. The sources from which the information was gathered should be made crystal apparent in the report. Every page needs to have a number, which should be centred at the bottom of the page. All tables, figures, and appendices must be appropriately labeled and consecutively numbered or lettered. The report must be printed, bound (ideally with soft binding), and contain at least 25 pages.
9. The internship training report should be submitted to the department within a month from the date of commencement of third semester.
10. However, such submission shall not be accepted after the end of third semester Examinations.

UNIT II

Evaluation of the Internship:

i. The internship program will be assessed by the assigned Internship Programme Coordinator from the host institute.
ii. Evaluation will be done by the Internship Programme Coordinator of the host institute and through seminar presentation/viva-voce.
iii. The presentation should be specific, clear and well analyzed, and indicate the specific sources of information.
iv. According to the statement of the draft the evaluation of the interns will be done as per the sincerity and research output of the students. In

addition the evaluation will also be assessed according to the activity of the log book, format of presentation, quality of the report made by the interns, uniqueness, skill sets and evaluation report of the internship coordinator.

UNIT III

College Guide Manual – Summer Internship Program

1. The Internship Programme Coordinator should give proper procedures to the intern before and after the Internship.
2. The Internship Programme Coordinator should interact with the research labs/industry/recognized institution at least once before completion of the internship.
3. The weekly report submitted by the student should be reviewed and reported to the Internship Programme coordinator.

UNIT IV

Internal: 100 marks

Academic Industrial Activity- Programme Completion certificate - 30 marks
Internship report - 30 marks
Presentation - 20 marks
Viva-voce - 20 marks

UNIT V

CONTENTS OF THE REPORT

Title page
Page for supervisory committee
Table of Acknowledgement
Academic Industrial Activity- Programme Certificate

Executive Summary

Introduction of the Report
Overview of the Organization
What I have Learned
Analyses
Summary
Recommendations and Conclusion
References
Appendices

Recommended Text:

1. Dawson, C. 2002. Practical research methods. UBS Publishers, New Delhi.
2. Stapleton, P., Yondeowei, A., Mukanyange, J., Houten, H. 1995. Scientific

writing for agricultural research scientists – a training reference manual. West Africa Rice Development Association, Hong Kong.

Naan Mudhalvan
FLORICULTURE

Objectives:

- The course provides thorough knowledge about the commercial cultivation of flowers and different value added products prepared from it.
- It highlights the potential of these studies to become an entrepreneur.

UNIT –I

Floriculture and its importance, cultivation of Jasmine and Rose.

UNIT– II

Commercial production and cultivation techniques of Marigold and Gerbera.

UNIT–III

Cultivation techniques of Anthurium and Heliconia, cut flower production, importance of cut flower production, package & export.

UNIT– IV

Importance of flowers in perfumery, Extraction of Jasmine oil and Rose oil.

UNIT –V

Introduction, General Principles of flower arrangement, Western and Japanese flower arrangement.

REFERENCES:

1. Kumar, N. 1997. Introduction to Horticulture, Rajalakshmi Publication, Nagarcoil.
2. Kumaresan, V. 2009. Horticulture, Saras Publication, Nagarcoil.
3. Randhawa, G.S. 1973. Ornamental Horticulture in India. Today and Tomorrow Printers and Publishers, NewDelhi.
4. Vishnu Swarap, 1997. Garden flowers, National Book Trust, India.