MANONMANIAM SUNDARANAR UNIVERSITY,
TIRUNELVELI-12

SYLLABUS

PG - COURSES – AFFILIATED COLLEGES

Course Structure for MA Economics

(Choice Based Credit System)

(with effect from the academic year 2024-2025 onwards)

Semester-IV				
Part	**Subject Status**	**Subject Title**	**Subject Code**	**Credit**
III	CORE	PLANT PHYSIOLOGY AND PLANT METABOLISM		5
III	CORE	BIOCHEMISTRY & APPLIED BIOTECHNOLOGY		5
III	CORE	LABORATORY COURSE – 7 COVERING CORE PAPER XVI		2
III	CORE	LABORATORY COURSE- 8 COVERING CORE PAPER XVII		2
III	CORE	PROJECT WITH VIVA VOCE		4
III	ELECTIVE	3. GENE CLONING AND GENE THERAPY		2
III	SEC	1. BOTANY FOR COMPETITIVE EXAMINATIONS (NET/UGCSIR/SET/TRB/UPSC/TNPSC/ OTHER COMPETITIVE EXAMINATIONS)		2
		EXTENSION ACTIVITY		1

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 PHYSIOLOGY AND PLANT METABOLISM

Learning objectives

- To acquire knowledge on the functional aspects of plants.
- To understand the biophysical and biochemical processes of plants.
- To study the metabolism of plants.
- To learn the plant growth regulations.
- To know the adaptive mechanisms of plants in adverse environmental conditions.

UNIT I

Water Relations: Physical and chemical properties of water – Components of water potential - Plasmolysis - Apoplast and Symplast concept - water transport through the xylem — Transpiration - stomatal structure and function – mechanism of stomatal movement – antitranspirants - mineral nutrition – essential nutrients – macro and micro nutrients – deficiencies and plant disorders –translocation of solutes – pathways and mechanisms. Phloem loading and unloading

UNIT II

Photosynthesis: The physical nature of light – the absorption and fate of light energy – absorption and action spectra- Ultrastructure of Chloroplast; Photosynthetic Electron Transport and Photophosphorylation (cyclic and noncyclic): Light Harvesting complexes - Photosystem I & II and Oxidation of Water; Chemiosmosis theory - Carbon metabolism: C3, C4 and CAM pathways and their distinguishing features - photorespiration and its significance.

UNIT III

Plant respiration – Glycolysis – TCA cycle– Electron Transport – oxidative phosphorylation and ATP synthesis - Pentose Phosphate Pathway – Respiration and its significance in crop improvement. Nitrogen fixation (Biological - symbiotic and non-symbiotic), Physiological role of nitrogen fixation

UNIT IV

Growth and development – Phases of plant growth – growth types- Growth substances - Auxins, gibberellins, cytokinins, abscisic acid, ethylene, brassinosteroids - physiological effect and mechanism of action in agricultural and horticultural crops – Photoperiodism – classification of plants and mechanism of flowering – Phytochrome and their action on flowering – Vernalization- Mechanism and its practical application, biological rhythms. Movements in plants. Seed dormancy and causes and seed germination and their biochemical changes. Plant senescence –Types and mechanism of senescence-

UNIT V

Abscission: Morphological and biochemical changes – Significance. Fruit ripening- Biochemical, Physiological changes and control of fruit ripening. Plant response to environmental stress: Biotic and Abiotic stress – Water, temperature, light and salinity- Adaptive mechanism to various stresses (avoidance, escape, tolerance)– stress responsive proteins – anti-oxidative mechanism.

Recommended texts

1. Gauch, H.G.1972. Inorganic Plant Nutrition. Hutchinson & Dowd. New York.
2. Govindji. 1982. Photosynthesis. AP. New York.
3. Jacob, W.P. 1979. Plant Hormones and Plant Development. Cambridge University Press. Cambrigde
4. Khan, A.A. 1982. The Physiology and Biochemistry of Seed development, Dormancy and Germination. Elesiver. Amsterdam.
5. Salisbury, F. B.C.W. Ross.1991. Plant Physiology. Wassworth Pub. Co. Belmont.
6. Ting, I.P. 1982.Plant Physiology. Addison Wesley Pb. Philippines.
7. Sage, R and R.K. Monson (eds). 1999. The Biology of C4 Plants AP New York.
8. Postgate, J. 1987. Nitrogen Fixation. 2nd Edition Cassel, London.
9. Lincoln Taiz, Eduardo Zeiger, Ian Max Moller and Angus Murphy. 2015. Plant Physiology. 6th Ed., Sinauer Associates.
10. Stacey, G.R.H. Burris and Evans, H.J. 1992. Biological Nitrogen Fixation. Chapman and Hall, New York
11. Mann, J. 1987. Secondary Metabolism Clarendron Press, Oxford.
12. Jain, V.K. 2017. Plant Physiology, S.Chand & Company Ltd. New Delhi.
13. Lincoln, T, Eduardo, Z, Ian Max, M, and Angus, M. 2018. Fundamentals of Plant Physiology. Sinauer Associates Inc., US.
14. Pandey, N.S and Pandey, P. 2016. Textbook of Plant Physiology. Daya Publishing House, New Delhi.
15. Taiz, L. Zeiger, E., Moller, I.M and Murphy, A. 2015. Plant Physiology and Development 6th Edition. Sinauer Associates, Sunderland, CT.
16. Guowei Li Veronique Santoni ChristopheMaurel. 2014. Plant aquaporins: Roles in plant physiology. Biochimica et al. Biophysica Acta (BBA) - General Subjects Volume 1840, Issue 5, Pages 1574-1582.

Reference Books

1. Bidwell, R.G.S. 1974. Plant Physiology, Macmillan Publisher, Boston.
2. Devlin, R.M. 1996. Plant Physiology, PWS publisher, Boston.
3. Jain, V.K. 2017. Fundamentals of Plant Physiology. Chand & Company Ltd., New Delhi.
4. Gontia. 2016. A textbook of Plant Physiology. Satish Serial publishing House, New Delhi.
5. Leopold, A.C, 1994. Plant Growth and Development, McGraw Hill, New York.
6. Lincoln Taiz et al., 2014. Plant Physiology and Development. Sinauver Associates Inc. Publishers, Sunderland, Massachusetts.
7. Moore, T.C. 1989. Biochemistry and Physiology of Plant Hormones (2nd Edition). SpringerVerlag, New York, USA.
8. Noggle, R.G and Fritz, G.J. 2010. Introductory Plant Physiology, PHI Learning Pvt Ltd, New Delhi.
9. Park S. Nobel. 2005. Physicochemical and Environmental Plant Physiology. Elsevier Academic Press, New York.
10. Panda, S.K, 2005. Advances in Stress Physiology of Plants. Scientific Publishers India, Jodhpur.
11. Salisbury, F.B and Cleon Ross, 2007. Plant Physiology, Wadsworth Publishing Company, Belimont.
12. Shinha. R.K. 2007. Modern Plant Physiology. Ane Books India, New Delhi.
13. William G. Hopkins, 1999. Introduction to Plant Physiology, John Wiley and sons, INC, New York.
14. Heldt, H.W. 2005. Plant Biochemistry, 3rd Edition. Elsevier Academic Press

Web resources

1. https://www.sciencedirect.com/topics/agriculture-and0biological-sciences/plant-physiology.
2. https://learn.careers360.com/biology/plant-physiology-chapter/
3. https://www.biologydiscussion.com/plants/plant-physiology/top-6-processes-ofplant-physiology/24154.
4. https://apan.net/meetings/apan45/files/17/17-01-01-01.pdf
5. https://basicbiology.net/plants/physiology
6. https://learn.careers360.com/biology/plant-physiology-chapter/4
7. https://swayam.gov.in/nd2_cec20_bt01/preview
8. https://www.nature.com/subjects/plant-physiology

BIOCHEMISTRY & APPLIED BIOTECHNOLOGY

Learning Objectives

- To study the fundamentals and significance of Plant Biochemistry.
- To know the structure and properties of plant biomolecules.
- To learn the fundamental and applications of Plant Biotechnology.
- To study the mechanism of enzyme action and inhibition.
- To expose the students on the fundaments of genetic transformation.

UNIT I

Atomic structure: chemical bonds - ionic bond, covalent bond, coordinate covalent bond, hydrogen bond, hydrogen ion concentration (pH), buffers, acids and bases. Thermodynamics principle, First Law of Thermodynamics a) energy (b) Enthalpy (ii) second law of thermodynamics (a) Spontaneity and disorder (b) entropy (c) free energy, redox potential, dissociation and association constant, activation energy, binding energy. Electromagnetic spectrum, Fluorescence, Phosphorescence, Bioluminescence.

UNIT II

Classification of carbohydrates; Structure and properties of monosaccharides, Oligosaccharides, Polysaccharides – Glycoproteins. Protein and Amino acids: Structure, Classification and properties; Peptides - Structure: Primary, secondary, tertiary and quaternary structures. Classification of Lipids: Structure and properties of fatty acids, phospholipids, glycolipids, lipoproteins, cholesterol - functions.

UNIT III

Enzymes- Classification and nomenclature chemical nature of enzymes – factors affecting enzyme action – Michaelis – Menton constant, MM equation, Enzyme inhibition, co enzymes- mechanism of enzyme action, isoenzymes. Secondary metabolites: Structure, classification and properties of alkaloids, steroids, terpenoids, flavonoids, glycosides - their role.

UNIT IV

Selection and characterization of transgenic plants using selectable and reportable markers; PCR; qRT-PCR; Southern, Northern, ELISA and Western techniques; Agrobacterium tumefaciens mediated and biolistic plant transformation; Virus and Bacteria based transient gene expression systems. Virus induced gene complementation, induced gene silencing. Cytoplasmic male sterility and fertility restoration, terminator Seed technology, antisense technology for delayed fruit ripening, Plants as factories for useful products and pharmaceuticals.

UNIT V

Screening of Biotransformants - Fermentation techniques - Types. Industrial production of enzymes-amylase, protease & lipase and their applications. Immobilization for enzymes production. Antibiotic Penicillin production. Amino acid - Glutamic acid production. Production of Alcohol and Xanthan Gum. Bioreactors for culturing plant cells and production of secondary metabolites. Bioremediation - In situ and ex situ.

Recommended Text:

1. Satyanarayana, U and chakrapani, U. 2005. Biochemistry, Books and Allied (P) Ltd. Calcutta.
2. A.L. Lehninger, D.L. Nelson & M.M. Cox. 1993. Principles of Biochemistry. Worth Publishers, New York.
3. Stryer, L. 1994. Biochemistry. Freeman & Co, New York.
4. Zubay, G. 1988. Biochemistry. 1988 Macmillan Publishing Co, New York.
5. Harold, F.M. 1986. The vital force: A study of Bioenergetics. Freeman & Co, New York.
6. Jain, J.L. 2005. Fundamentals of Biochemistry. S. Chand & Co. New Delhi.
7. Lehninger, A.L. 1982. Principles of biochemistry, CBS Publication. Halford, N. 2015. Plant Biotechnology: Current and Future Applications of Genetically Modified crops, John Wiley and Sons.
8. Kumar, Pradeep. 2018. Advances in Microbial Biotechnology: Current Trends and Future Prospects. 10.1201/9781351248914.

Reference Books

1. Bonner, J. and Warner, W.H. 1961. Plant Biochemistry. Academic Press. Inv. New York.
2. Gupta, S.N. 2016. Biochemistry Rastogi Publications, Meerut.
3. Satyanarayana, U. and Chakkrapani, U. 2013. Biochemistry. Elsevier India Pvt. Ltd & Books Allied Pvt. Ltd, New Delhi.
4. Nelson, D.L. and Cox, M.M. 2017. Lehninger's Principles of Biochemistry, Prentice Hall, International N.J, 7th Edition.
5. Heldt, H-W. 2005. Plant Biochemistry, 3rd Edition. Elsevier Academic Press.
6. Buchanan, B.B., Grissem, W. and Jones, R.L. 2000. Biochemistry and molecular biology of plants. 5th Edition. Wiley-Blackwell.
7. Jain, J.L., Jain, S. and Jain, N. 2016. Fundamentals of Biochemistry. Chand Publishing, New Delhi.
8. Chawla, H.S. 2009. Introduction to Biotechnology, 2nd edn. Oxford IBH, ISBN:978-81-204- 1732-8.
9. Halford, N. 2015. Plant Biotechnology: Current and Future Applications of Genetically Modified Crops, John Wiley and Sons.

Web sources:

1. http://priede.bf.lu.lv/grozs/AuguFiziologijas/Augu_biokimija/Plant%20Biochemistry204.pdf
2. http://www.brainkart.com/subject/Plant-Biochemistry_257/
3. https://swayam.gov.in/nd2_cec20_bt12/preview
4. https://www.biorxiv.org/content/10.1101/660639v2
5. https://www.scribd.com/document/378882955/
6. https://nptel.ac.in/courses/102/107/102107075/
7. https://plantae.org/plant-physiology-top-articles-of-2020-based-on- altmetric-scores/
8. https://britannica.com/technology/biotechnolog/
9. https://manavrachna.edu.in/blog/scope-of-biotechnology/

LABORATORY COURSE 7- PLANT PHYSIOLOGY AND PLANT METABOLISM

Learning Objectives

- Extract bimolecule of diverse nature from different sources so that they will be able to assess the metabolic profile of their source material.
- Recognize the role that water plays in several physiological processes in plants.
- To learn the fundamental and applications of Plant Biotechnology.
- Learn about chromatographic techniques.
- Expose the students to gain recent advances in molecular biology.

EXPERIMENTS

UNIT I

1. Determination of water potential using gravimetric method.
2. Effect of pH on protoplasmic membrane.
3. Effect of detergent on protoplasmic membrane.3.

UNIT II

1. Separation of chloroplast pigments using column chromatographic technique.
2. Experiment to study the rate of Hill activity of isolated chloroplast by dyereduction.
3. Extraction and determination of chlorophyll a /chlorophyll b ratio in C3 and C4 plants.

UNIT III

1. Colorimetric estimation of starch
2. Estimation of proline in stressed and non-stressed leaf samples
3. In vivo assay for nitrate reductase in C3 and C4 leaf tissues

UNIT IV

Demonstration experiments

1. Dilatometer
2. Potato Osmoscope
3. Measurement of root pressure
4. Four leaf experiment
5. Thistle funnel experiment
6. Arc auxanometer

UNIT V

Spotters – Photographs/diagrams

1. Avena curvature test, Bolting effect, Munch hypothesis, Emerson red drop/ enhancement effect, action and absorption spectrum
2. Movements in plants – Thigmotropism, Phototropism, Seismonastic, Thigmonastic, Photonastic

Recommended texts

1. Bendre, A.M. and Ashok Kumar, 2009. A textbook of practical Botany. Vol.I & II. Rastogi Publication. Meerut. 9thEdition.
2. Manju Bala, Sunita Gupta, Gupta NK. 2012. Practicals in Plant Physiology and Biochemistry. Scientific Publisher.
3. Poonam Sharma – Natu, Vijay Paul and P.S. Deshmukh. 2021. Laboratory manual Experimental Plant Physiology. Division of Plant Physiology, Indian Agricultural Research Institute, New Delhi.
4. Singh, A.K Anand Kumar Pandey and Ankit Singh 2020 Laboratory Manual of Plant Physiology AkiNik Publications, 169, C-11, Sector-3, Rohini-110085, New Delhi, India.
5. Samaiya Subrata Sharma R. K., Gyanendra Tiwari, R. Shivraj krishnan, Sunil Pandey, Preeti Sagar Nayak 2022 A Practical Manual on Fundamentals of Plant Physiology BFC Publications Pvt. Ltd CP – 61, Viraj Khanad, Gomti Nagar, Lucknow, UP 226010.

Reference books:

1. Rajesh Kumar Asok Kumar Bera, Bandana Bose (2023) PG Practical Manual Experimental Plant Physiology and Biochemistry Manual Jain Brothers 16/873, East Park Road, Karol Bagh, Near Dr. N.C. Joshi Hospital, New Delhi-110 005
2. Bala, M., Gupta, S., Gupta, N.K and Sangha, M.K. 2013. Practicals in plant physiology and biochemistry. Scientific Publishers (India).
3. Bendre, A. M and Ashok Kumar. 2009. A textbook of Practical Botany. Vol. I & II. Rastogi Publication. Meerut. 9th Edition.

Web resources

1. https://www.amazon.in/Laboratory-Manual-Physiology-Mukesh-Amaregouda/dp/6133993502
2. https://www.kopykitab.com/A-Laboratory-Manual-of-Plant-Physiology-Biochemistry-and-Ecology-by-Akhtar-Inam
3. https://www.srcollege.edu.in/temp/lms/Manuals/Practical-IV.pdf
4. https://www.rlbcau.ac.in/pdf/Forestry/FBT-111%20%20Plant%20Physiology.pdf
5. https://jru.edu.in/studentcorner/lab-manual/agriculture/Fundamentals%20of%20Crop%20Physiology.pdf
6. https://www.google.com/search?q=plant+physiology+practical+manual+pdf&oq=PLANT+PHYSIOLOGY+PAFACTICA%3B&aqs=chrome.1.69i57j0i13i512l3j0i13i30j0i8i13i30j0i390i512i650l4.15177j0j15&sourceid=chrome&ie=UTF-8#ip=1

LABORATORY COURSE – 8 BIOCHEMISTRY & APPLIED BIOTECHNOLOGY

Learning Objectives

- Extract bimolecule of diverse nature from different sources so that they will be able to assess the metabolic profile of their source material.
- Recognize the role that water plays in several physiological processes in plants.
- To learn the fundamental and applications of Plant Biotechnology.
- Learn about chromatographic techniques.
- Expose the students to gain recent advances in molecular biology.

EXPERIMENTS

UNIT I

1. Preparation of normal (NaOH), percentage (NaCl, HCl), ppm (NaCl) and molar (NaOH, Sucrose) solutions
2. Preparation standard graph for protein, sugar and amino acids
3. Estimation of protein content by Lowry method
4. Estimation of amino acids by ninhydrine method

UNIT II

1. Estimation of sugar by anthrone method
2. Estimation of total phenol content by Folin Ciocalteu Method
3. Estimation of flavonoid
4. Estimation of ascorbic acid

UNIT III

1. Extraction of caffeine from coffee
2. Separation of amino acids using paper chromatographic technique.
3. Separation of lipids by TLC
4. Determination of saponification number of edible oil

UNIT IV

Spotters

1. Secondary, tertiary and quaternary structures of protein
2. Michaelis–Menten kinetics, pH scale
3. Images of chemical bonds, Fluorescence, Phosphorescence
4. Mechanism of enzyme action – lock and key hypothesis, induced fit theory

UNIT V

Spotters

1. Study of basic equipments used in biotechnology laboratory – Hot air oven, Laminar air flow chamber, PCR, Refrigerated centrifuge, Transilluminator, Autoclave, Gel-Doc, Fermenter
2. Agrobacterium tumefaciens mediated transformation of plants
3. Biolistic gene gun method of plant transformation
4. Cytoplasmic male sterility, antisense technology.

Recommended Text:

1. Plummer, D. 1988.An introduction to Practical Biochemistry, Tata McGraw–Hill Publishing Company Ltd., New Delhi.
2. Palanivelu, P. 2004. Laboratory Manual for analytical biochemistry and separation techniques, School of Biotechnology, Madurai Kamaraj University, Madurai.
3. Jayaraman. J. 1981.Laboratory Manual in Biochemistry. Whiley Eastern Limited, New Delhi.
4. Bendre, A.M. and Ashok Kumar, 2009. A textbook of practical Botany. Vol.I & II. Rastogi Publication. Meerut. 9th Edition.
5. Manju Bala, Sunita Gupta, Gupta NK. 2012. Practicals in PlantPhysiology and Biochemistry. Scientific Publisher.
6. Joy, P.P., Surya, S and Aswathy, C. 2015. Laboratory Manual of Biochemistry, Agricultural University, Pineapple Research Station, Ernakulam, Kerala.
7. George M Malacinski. 2015. Freifelders Essentials of Molecular Biology (4th ed.) Jones & Bartlett.
8. Gupta P.K. 2017. Cell and Molecular Biology (5th ed.), Rastogi Publications, Meerut.
9. Kumar, H.D. 2007. Molecular Biology and Biotechnology, Vikas Publishing House, NewDelhi.
10. Shivakumar, S. 2002. Molecular analysis: Laboratory Manual University Press, Palkalai Nagar, Madurai, India.

Reference books

1. Bala, M., Gupta, S., Gupta, N.K and Sangha, M.K. 2013. Practicals in plant physiology and biochemistry. Scientific Publishers (India).
2. Wilson, K and J. Walker (Eds). 1994. Principles and Techniques of Practical Biochemistry (4th Edition) Cambridge University Press, Cambridge.
3. Bendre, A. Mand Ashok Kumar. 2009. A textbook of practical Botany. Vol.I & II. Rastogi Publication. Meerut. 9thEdition.
4. Wilson, K and J. Walker. 2005. Principles and Techniques of Practical Biochemistry, 5th Edition. Cambridge University press, New York.
5. Rodney Boyer. 2000. Modern Experimental Biochemistry, 3rd Edition. Published by Addison Wesley Longman. Singapore.
6. Glick, B.R and J.E. Thompson. 1993. Methods in Plant Molecular Biology and Biotechnology. CRC Press, Boca Raton, Florida.
7. Glover, D.M and B.D. Hames (Eds). 1995. DNA cloning 1: A Practical Approach; Core Techniques, 2nd edition PAS, IRL press at Oxford University Press, Oxford.
8. Hackett, P.B. and J.A. Fuchs, J.W. Messing. 1988. An Introduction to Recombinant DNA Techniques: Basic Experiments in Gene Manipulation. The Benjamin/ Cummings Publishing Co., Inc Menlo Park, California. 8. Hall, RD. (Ed).1999. Plant Cell Culture Protocols. Humana Press, New Jersey.
9. Gelvin, S.B., Schilperoort, R.A. (Eds.). 2000. Plant Molecualr Biology Manual.

Web resources:

1. file:///C:/Users/User/Downloads/2021%20Botany%20Syllabus%20after%20BoS%20formatted1%20(1).pdf
2. https://kau.in/document/laboratory-manual-biochemistry
3. https://www.amazon.in/Practical-Manual-on-Plant-Biochemistry/dp/6200539790
4. https://www.kopykitab.com/A-Laboratory-Manual-of-Plant-PhysiologyBiochemistryand-Ecology-by-Akhtar-Inam
5. https://www.kopykitab.com/Cell-And-Molecular-Biology-A-Lab-Manual-by-KVChaitanya

PROJECT with VIVA-VOCE

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.

GENERAL GUIDELINES

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 100 marks in total on the scale of the maximum of 50 marks for the internal and the external each.
5. 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 50 marks for the internal and the external each.

All the candidates of M.Sc. (Botany) are required to undergo a major project and submit the following:

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 50 marks which will be conducted by both the internal and external examiners during end semester university practical examinations.

Internal: 50 marks

I Review – Selection of the field of study, topic and literature collection - 15 marks
II Review – Research design and data collection - 20 marks
III Review – Analysis and conclusion, preparation of rough draft – 15 marks

External: 50 marks

Evaluation of project report (30 marks)
Originality of the approach - 10 marks
Neat presentation of report – 10 marks
Results and Discussion – 10 marks
Division of marks for viva (20 marks)
Knowledge on the content - 10 marks
Viva-voce - 10 marks

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.

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 Text:

1. Wilson, Kand 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, New York.
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-Biochemistryand-Ecology-by-Akhtar-Inam
5. https://kau.in/document/laboratory-manual-biochemistry

GENE CLONING AND GENE THERAPY

Learning Objectives

- To give a clear knowledge of genetic engineering, cloning vectors, enzymes involved in cloning.
- To understand the procedure involved in recombinant DNA technology and restriction mapping.
- To focus on the application of gene cloning in plants and animals.
- To enable the students to information onGene Therapy.
- To raise student to create transgenic plants for hybrid seed production and molecular farming.

UNIT I

Definition of genetic engineering, gene cloning and recombinant DNA cloning vectors: plasmids, bacteriophages, plant and animal vectors. Restriction enzymes; DNA modifying enzymes: nucleases, polymerases, phosphatases and ligases. Construction of genomic and c-DNA libraries

UNIT II

Gene cloning in prokaryotes and eukaryotes, Isolation of DNA to be cloned, insertion of DNA fragments into vector. Use of Restriction Linkers: use of Homopolyer tails, Transfer of recombinant DNA into Bacteria cell. Selection of clones.

UNIT III

Gene Therapy: Definition, Germ cell and Somatic cell. Amniocentesis in human; patient therapy, embryo therapy, Recombinant DNA technology for human insulin, Hepatitis B vaccine, Tissue plasminogen activator, clotting factor VIII

UNIT IV

Types and uses of molecular markers- RFLP; PCR based markers like RAPD, SCAR, SSR, STS, CAPS, AFLP, SNP. DNA finger printing; Gene Tagging. Physical methods of gene delivery. Gene transfer techniques. Genetic counselling – Eugenics, Euthenics.

UNIT V

Genomics: Structural genomics, microsatellite maps, cyotogenetic maps, physical maps, positional cloning, chromosome walks and jumps, Genome sequencing, genome databases, human genome sequencing project. Functional genomics. transcriptome, proteome and metabolome, Microarrays and gene-chips. Metabolomics: Identification and quantification of cellular metabolites in biological samples. Pharmacogenomics and drug designing.

Recommended Text:

1. Das, H.K. 2010. Textbook of Biotechnology (4th edition). Wiley India Pvt. Ltd. New Delhi
2. Gamborg, O.L and G.C. Phillips (eds). 1995. Plants, genes and agriculture. Jones and Bartlett Publishers.
3. Verma, P.S and Agarwal V.K. 2009. Genetic Engineering. S. Chand & Co. Ltd. New Delhi
4. Kreuzer, H and A. Massey. 1996. Recombinant DNA and biotechnology. A guide for teachers. ASM Press.
5. Ramavat, K.G. 2006. Plant Biotechnology. S. Chand and Co. Ltd., New Delhi.
6. Chawla, H.S. 2009. Introduction to Biotechnology. 2nd edn. Oxford IBH, ISBN: 978-81-204-1732-8.
7. Halford, N. 2015. Plant Biotechnology: Current and Future Applications of Genetically Modified crops, John Wiley and Sons.
8. Kumar, Pradeep. 2018. Advances in Microbial Biotechnology: Current Trends and Future Prospects. 10.1201/9781351248914.
9. Thieman. 2014. Introduction to Biotechnology 3rd Edition. Pearson Education India.
10. Khan. I.A. and A. Khanum .2004. Fundamentals of Biotechnology – Forensic Science Genetic Engineering. Ukaaz publication, Hyderabad.
11. Gupta. P.K. 1998. Elements of Biotechnology. Rastogi publications, Meerut.

Reference books:

1. Smith. J.K. 1996. Biotechnology – 3rd Ed. Cambridge Univ. Press, Cambridge.
2. Slater, A. Scott, N and Fowler, M. 2008. Plant Biotechnology: The Genetic Manipulation of Plants. Oxford University Press Inc.
3. Reynolds, P.H.S. 1999. Inducible Gene Expression in Plants. CABI Publishing, U.K.
4. Chawla, H.S. 2009. Introduction to Biotechnology, 2nd edn. Oxford IBH, ISBN: 978-81-204-1732-8.
5. Halford, N. 2015. Plant Biotechnology: Current and Future Applications of Genetically Modified Crops, John Wiley and Sons.
6. Brown T.A. 2001. Gene Cloning and DNA Analysis- An Introduction (4th edition). Blackwell Science. Oxford.
7. Clark, D.P and Pazdernik, N.J. 2009. Biotechnology- Applying the Genetic Revolution. Elsevier Academic Press. USA.
8. Glick B.R and J. J. Pasternak. 2009. Molecular Biotechnology, Panima Publication Co.
9. Harisha, S. 2007. Biotechnology Procedures and Experiments Handbook. Infinity Science Press Llc. Hingham. MA.
10. Mosier N.S and Ladisch M.R. 2009. Modern Biotechnology- Connecting Innovations in Microbiology and Biochemistry to Engineering Fundamentals. John Wiley & Sons Inc. New Jersey.
11. Primrose S., Twyman R. and Old B. 2001. Principles of Gene Manipulation (6^{th} ed.). Blackwell Science. Oxford.
12. Ignacimuthu, S.1998. Applied Plant Biotechnology. Tata Mc Graw Hill, publishing company Ltd., New Delhi.
13. Neal Stewart, Jr. 2008. Plant Biotechnology and Genetics: Principles, Techniques and Applications. JohnWiley & sons Inc.

Web resources:

1. https://www.amazon.in/Gene-Cloning-Manipulation-Christopher-Howeebook/dp/B000SK4YLI
2. https://www.amazon.in/Gene-Cloning-Steve-Minchin-ebook/dp/B000SHTUT2
3. https://www.futuremedicine.com/doi/book/10.2217/9781780842134
4. https://www.researchgate.net/publication/51144570_Introduction_to_Gene_Therapy_A_Clinical_Aftermath
5. https://link.springer.com/book/10.1007/978-88-470-1643-9

PROFESSIONAL COMPETENCY SKILL / SKILL ENHANCEMENT COURSE III

BOTANY FOR COMPETITIVE EXAMINATIONS

(NET/UGC-CSIR/SET/TRB/UPSC/TNPSC/other competitive examinations)

Learning Objectives

- Competitive examinations syllabus shall introduce the concepts of breadth and depth in learning.
- Shall produce competent plant biologists who can employ and implement their gained knowledge in basic and applied aspects that will profoundly influence competitive ability.
- Will increase the ability of critical thinking, development of scientific attitude, handling of problems and generating solutions.
- Students will make them competent enough for doing jobs in Govt. and private sectors of academia, research and industry along with preparation for national competitive examinations
- Students will be able to contribute research in the field of plant sciences.

UNIT I

Microbiology: Structure and reproduction of viruses, bacteria and fungi. Applications of microbes in agriculture, industry, medicine and in control of water pollution.

Plant Pathology: Important crop diseases caused by viruses, bacteria, mycoplasma, fungi and nematodes with special reference to India; Classification of Plant Diseases Structural and biochemical host defense mechanisms;

Economic Botany (Botanical name, family, useful part and uses): cereals, fibre yielding plants, plantation crops, sugar yielding plants, narcotics, vegetables, oil yielding plants, pulses, beverages and minor forest products - resins, gums, tannin and rubber yielding plants,

UNIT II

Cryptogams: Algae, fungi, lichens, bryophytes, pteridophytes - structure and reproduction and economic importance.

Phanerogams: Gymnosperms: structure, reproduction and economic importance; Geological time scale; Type of fossils and their study techniques. Angiosperms: International Code of Botanical Nomenclature; Origin and evolution of angiosperms, natural and phylogenetic systems of classification.

UNIT III

Cell Biology: Ultrastructure of cell - cell wall, plasma membrane, chloroplast, endoplasmic reticulum, mitochondria, lysosomes, flagella and nucleus. Cell division – mitosis, meiosis and their significance; Chromosome – morphology, fine structure, Types – giant chromosome, Isochromosome

Bio-chemistry: Chemistry of carbohydrates, proteins, amino acids and lipids - structure, properties and classification. Nucleic acids – structure and properties, types of DNA – different types of RNA, properties and functions. Enzymes – Properties, mode of action, nomenclature and classification.

UNIT IV

Plant Physiology: Photosynthesis – Light reaction and carbon fixation pathways; C3, C4 and CAM pathways; Mechanism of phloem transport; Respiration - Glycolysis, Krebs cycle, Electron Transport. Nitrogen fixation – symbiotic and non-symbiotic. Auxins, cytokinins. Gibberellins, phytochromes – role and mode of action.

Genetics: Mendelian and non-mendelian inheritance – linkage and crossing over.

Mutation – Mutagenic agents; Chromosomal aberrations. Nucleic acids as genetic material – Replication of DNA – Methods and models in DNA repair mechanism – split genes –Jumping and mobilic genes – concepts of gene – Cistron, Muton and recon.

UNIT V

Ecology: Ecological factors – their classification and interaction. Synecology – classification of plant communities. Raunkiaer's life – forms – Ecological succession –causes and effects climax concept. Eco system – components and inter relationship. Bio-geo-chemical cycles. Major sanctuaries, National parks in Tamil Nadu.

Plant Geography: Principles of Plant Geography Dispersal and migration – Types – Age and Area hypothesis – continuous range, cosmopolitan, circum polar, circum boreal and circum austral, pantropical Discontinuous distribution – Wegner's theory of continental drift.

Recommend text Books

1. Pulliah T, Varalakshmi Narayana D, and P Suresh 2021 Botany for Competitive Examinations: (Useful for UPSC-Indian Forest Service, Civil Services, PCS, ASRB CSIR - NET, ICAR-NET and Other Competitive Exams) Astal crackers publication
2. Sunit Mitra 2017 Botany for Competitive Examinations Edition 1 Academic Publishers
3. Pullaiah T 2021 Objective Botany: Question Bank for Civil Service Examinations NET, SET, Ph.D. And Allied Examination: Regency Publications
4. Mitra, S. 2016. Botany for competitive examinations, Academic Publishers.
5. Mohd Akil Shahezad. 2018. M.C.Qs. in Botany, Library Book House.
6. Sharma, P.C. 2017. Text Book of Plant Anatomy. Arjun Publishing House, New Delhi.
7. Sharma, O.P. 2017. Plant Taxonomy. (II Edition). The McGraw Hill Companies Taxonomy: Nair Datta
8. Thieman. 2014. Introduction to Biotechnology 3rd Edition. Pearson Education India.

Reference Books

1. De Robertis and De Robertis. 1990. Cell and Molecular Biology, Saunders College, Philadelphia, USA.
2. Gardner, E.J., Simmons, M.J and Snustad, D. 1991. Principles of Genetics, John Wiley Sons Inc., 8th Edn., New York.
3. Salisbury, F. B.C.W. Ross.1991. Plant Physiology. Wassworth Pub. Co. Belmont.
4. Sharma, P.D. 2017. Ecology and Environment- Rastogi Publication, Meerut.
5. Vardhana, R. 2009. Economic Botany. 1st ed. Sarup Book Publishers Pvt Ltd. New Delhi.
6. Power, C.B and Daginawa, H.F. 2010. General Microbiology: Himalaya Publishing House Pvt Ltd,
7. Rangasamy, G. 2006. Disease of crop plants in India (4th edition). Tata Mc Graw Hill New Delhi.
8. Singh, V., Pande, P.C and Jain, D.K. 2021. A Text Book of Botany. Rastogi Publications, Meerut.
9. Bhojwani, S.S. Bhatnagar, S.P and Dantu, P.K. 2015. The Embryology of Angiosperms (6th revised and enlarged edition). Vikas Publishing House, New Delhi.

Web resources

1. https://www.amazon.in/BOTANY-COMPETITIVE-EXAMINATIONS-SUNITMITRA/dp/9383420898
2. https://www.amazon.in/Botany-Competitive-Examinations-UPSC-Indian-Competive/dp/B08VWB64BC
3. https://www.ssclatestnews.com/botany-book-pdf-free-download-for-competitive-exams/
4. https://sscstudy.com/botany-for-competitive-exams-pdf/
   https://www.amazon.in/Botany-Entrance-Examination-Anupam-Rajakebook/dp/B089S1GLMP

EXTENSION ACTIVITY

Learning Objectives

- To arouse social consciousness of the students by providing them opportunities to work with and among the people.
- To develop an awareness and knowledge of social realities to have concern for the well-being of the community and engage in creative and constructive social action.
- To provide with rich and meaningful educational experiences to them in order to make their education complete and meaningful.
- To give them the opportunities for their personality development Identify the needs and problems related to environment and involve them in problem solving process.

A. GUIDELINES FOR THE EXTENSION ACTIVITY COURSE

1. Campus Work (30 hours/semester) (group activity – each group maximum number of students - 5)

Development & maintenance of Botanical Garden, Lawn, Green house, Herbal Garden, Kitchen Garden / preparation and maintenance of a museum / seed bank (30 specimens) etc. on the college campus

2. Adopted Village – (Near the College) (20 hours / semester)

Activities including

a) Plantation of tree saplings, Medical Camps, Rallies, and any activity relating to environmental awareness, Disposal of garbage & composting, Environmental sanitation, Swachh Bharat Mission scheme program, Plastic and Waste Collection Drive, Celebration / observation of Important days in villages, etc.

At the end of the semester each student should submit a report and data sheet of the events with GIS photographs.

b) Survey on Environmental awareness/ environmental issues/ climate change /pollution/conservation etc.

Students should prepare a questionnaire about any one theme related to the environment/traditional knowledge/ conservation etc. The questionnaire contains a minimum of 20 questions to reflect the purpose of their specific subject. The survey will be conducted with a minimum of 30 participants. During data collection, participants were requested to fill out the questionnaire completely. Data analysis focuses on organizing information and making logical or statistical inferences; interpretation, and drawing conclusions. Prepare and submit a report for external valuation. Report should include title, certificate by teacher in-charge, introduction, results, analysis, conclusions and action required.

B. SCHEME OF EVALUATION

Internal

Evaluation Criteria	**Maximum marks for each category**
Active participation in the campus work	15
Active participation in the village work	15
Plan of work and calendar of operations, Follow through plan of work	10
Preparation and submission of questionnaire, data sheet and report with GIS photos	10
Total	**50**

External

Evaluation Criteria	**Maximum Marks for Each Category**
PowerPoint presentation of activities done with GIS photos	20
Viva - Knowledge, Attitude	10
Questionnaire report	10
Data sheet and report with GIS photos	10
Total	**50**