MANONMANIAM SUNDARANAR UNIVERISTY,
TIRUNELVELI-12

SYLLABUS

PG - COURSES – AFFILIATED COLLEGES

Course Structure for M.Sc. Botany
(Choice Based Credit System)
(with effect from the academic year 2021- 2022 onwards)

Semester-III				
Part	**Subject Status**	**Subject Title**	**Subject Code**	**Credit**
3	Core	TAXONOMY OF ANGIOSPERMS	ZBOM31	4
3	Core	BIOCHEMISTRY AND BIOPHYSICS	ZBOM32	4
3	Core	COMPUTER APPLICATION AND BIOINFORMATICS	ZBOM33	4
3	Core	RESEARCH METHODOLOGY AND BIOINSTRUMENTATION	ZBOM34	4
3	Practical	TAXONOMY OF ANGIOSPERMS, RESEARCH METHODOLOGY AND BIOINSTRUMENTATION	ZBOL31	2
3	Practical	BIOCHEMISTRY, BIOPHYSICS, COMPUTER APPLICATION AND BIOINFORMATICS	ZBOL32	2

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

A. **Scheme for internal Assessment**:
Maximum marks for written test: **15 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 and Seminar for 5 marks

The break up for internal assessment shall be:
Written test- 15 marks; Assignment -5 marks; Seminar-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.	Percentage of Marks	Letter Grade	Grade Point	Performance
1	90 - 100	O+	10	Outstanding
2	80 - 89	O	9	Excellent
3	70 - 79	A+	8	Very Good
4	60 - 69	A	7	Good
5	55 - 59	B+	6	Above Average
6	50 - 54	B	5	Pass
7	0 - 49	RA	-	ReAppear
8	Absent	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

Taxonomy of Angiosperms

Prerequisite:

Basic knowledge in Plant Morphology and Taxonomy gained from Undergraduate Programme

Objectives:

- To learn about identification and classification of plants
- To learn about preparation of herbarium and Plant Systematics
- To understand the role of taxonomy and importance of plants in day to day life

Outcome:

- Graduates will easily identify common and economically important plants
- Acquisition of knowledge about conservation of plants
- Herbal remedy knowledge acquisition

UNIT- I

Principles - Classification - (a) Artificial - Linnaeus (b) Natural -Bentham and Hooker (c) Phylogenetic - Cronquist and APG System. Taxonomic hierarchy – Species concept. Herbarium Prepartion – methods and importance, Digital/Virtual herbaria, role of regional, national and international herbaria. BSI

UNIT- II

International Code of Botanical Nomenclature : History of different codes – Botanical congress – ICBN to ICN. Principles of ICN – Priority of publication, Typification, Effective and Valid Publication. Rejection of names, Author citation – Botanical naming (Polynomial, Trinomial, Binomial)

UNIT – III

Modern Plant Systematics: Cladistics and Biosystematics, Numerical taxonomy, Molecular systematic, Chemotaxonomy, Serotaxonomy. Taxonomic Literature – Monographs, Floras, Catalogues, Revisions, Checklist

UNIT – IV

A detailed study with special reference to the following families:

Polypetalae: Magnoliaceae, Menispermaceae, Zygophyllaceae, Combretaceae, Lythraceae and Mimosaceae

Gamopetalae : Asclepiadaceae, Asteraceae, Pedaliaceae, Boraginaceae, Bignoniaceae, Scrophulariaceae, and Verbenaceae.

UNIT – V

A detailed study with special reference to the following families:

Monochlamydeae : Euphorbiaceae, Amaranthaceae, Nyctaginaceae, Polygonaceae, Piperaceae

Monocotyledons: Commelinaceae, Orchidaceae, Cyperaceae and Poaceae.

Reference books

1. Ahmedullah, M., and M.P. Nayar. 1987. Endemic Plants of the Indian Region.Vol. I. Botanical Survey of India. Howrah.
2. Cronquist, A. (1981). An Integrated System of Classification of Flowering Plants. Columbia University Press, New York.
3. Davis, P.H. and Heywood, V.H. 1973. Principles of Angiosperms Taxonomy. Robert E. Kreiger Pub. Co., New York.
4. Gamble, J.S., and C.E.C. Fischer. 1967. Flora of the Presidency of Madras. Vols. I - III. Botanical Survey of India. Calcutta.
5. Grant, W.F. 1984. Plant Biosystematics. Academic Press, London.
6. Greuter, W, (Ed.). 2000. International Code of Botanical Nomenclature. (St. Louis Code). Koeltz Vesentific Books. Germany.
7. Harrison, H.J.1971. New Concepts in Flowering Plant Taxonomy. Hieman Educational Books Ltd., London.
8. Henry,A.N., M.Chandrabose. 1980. An Aid to International Code of Botanical Nomenclature. Today & Tomorrow's Printers and Publishers. New Delhi.
9. Heywood, V.H. and Moore, D.M. 1984. Current Concepts in Plant Taxonomy. Academic Press, London.
10. Jain, S.K. and R.R. Rao. 1977. A Handbook of Field and Herbarium Methods. Today and Tomorrow's Printers and Publishers, New Delhi.
11. Jeffrey, C. 1982. Introduction of Plant Taxonomy, Cambridge University Press, Cambridge.
12. Lawrence, G.H.M. 1951. Taxonomy of Vascular Plants. The Macmillan Company. New York.
13. M.P. Nayar 1996. “Hot Spots” of endemic plants of India, Nepal and Bhutan. Trpical Botanic Garden and Research Institute, Thiruvananthapuram, India.
14. M.G. Simpson, 2010. Plant Systematics, Elsevier Academic Press, California, USA
15. S.N. Pandey and S.P. Misra 2008. Taxonomy of Angiosperms, Ana Books Pvt Ltd, New Delhi.
16. Gurcharan Singh 2018. Plant Systematics, Oxford & IBH Publishing Co., New Delhi.
17. B.P. Pandey, 2001. Taxonomy of Angiosperms, S.Chand (G/L) Company Ltd., New Delhi.
18. O.P. Sharma 2004. Plant Taxonomy Tata-McGraw-Hill Publishing Company.
19. Pandey Arun, Kasana Shruti 2020 Plant Systematics, Jaya Publishing House
20. Judd, Campbell, Kellogg, Donoghue 2015 Plant sytematics : A phylogenetic Approach, 4th edition, OUP USA.

Links

1. https://www.youtube.com/watch?v=TWQhP5IAgWU
2. https://www.youtube.com/watch?v=jak-Bfw8w4M
3. https://www.youtube.com/watch?v=woFRd76OWUo&t=189s

Practicals

1. Identification of plants mentioned in the syllabus
2. Preparation of dichotomous key.
3. Identification of Binomial using flora (J.S.Gamble).
4. Dissection and technical description of plants from locally available plants.
5. Workout nomenclatural problems regarding priority and author citations.
6. A study tour of Taxonomic interest (any area) – Submission of an album with 10 photographs of and 10 herbarium plant specimens from the prescribed families and field note book.

Biochemistry and Biophysics

Prerequisite:

Basic knowledge on structure and role of biomolecules - gained from undergraduate programme.

Objectives:

- To gain advanced knowledge about plant biomolecules
- To understand different metabolic pathways occurring in a cell
- To provide an advanced integral knowledge and understanding of topics in Biochemistry and Biophysics

Outcome:

- Acquisition of analytical and presentational skills
- Graduates will have a solid foundation and in-depth understanding of current topics in Biochemistry
- Knowledge gained about biofluorescent and bioluminescent compounds could be used as molecular reporters

UNIT -I

Biomolecules: Carbohydrates - properties of mono, oligo and polysaccharides. Structure and properties of trioses, tetroses, pentoses, hexoses, maltose, sucrose, starch and pectinglycosidic linkage, isomerism and mutarotation. Glycoproteins, amino sugars.

UNIT- II

Amino acids – Structure, classification, properties, functions and ionic forms. Zwitterion, isoelectric pH, optical isomers of aminoacids.

Proteins - primary, secondary, tertiary, quaternary protein - super secondary structures, properties, functions - denaturation and folding of proteins. Biologically important peptides.

UNIT – III

Lipids - Classification, structure, properties and functions - Fatty acids - saturated and unsaturated fatty acids - Structure of fatty acids and glycerol - phospholipids,

glycolipids, amphipathic lipids, steroids, lipoproteins. Biosynthesis and Oxidation of fatty acid - Gluconeogenesis.

UNIT - IV

Enzymes - Properties - Nomenclature and Classification. Coenzymes and isoenzymes, Enzyme kinetics - active sites - mechanism of enzyme action. Enzyme inhibiton – reversible, irreversible and allosteric inhibition. Enzyme specificity and regulation..

UNIT – V

Properties of light - Different components of electromagnetic radiation. Emission - Excitation - Fluorescence and Phosphorescence - Bioluminescence. Laws of Thermodynamics, free energy, Redox potential, activation energy. High energy compounds in biology and their significance.

Text books:

1. J.L. Jain, Fundamantals of Biochemistry. S. Chand and Company, New Delhi, 2005.
2. U. Satyanarayana, Biochemistry. Books and Allied (P) ltd, Kolkatta, 2005.

Reference Books

1. R.L.P. Adams, Burdon, R.H., Campbell, A.M., Leader, D.P. and Smile, R.M.S. The Biochemistry of Nucleic acids. Chapman and Hall Ltd. New York,1981.
2. O.P. Agarwal, Chemistry of organic natural products. Goel Publishing House, New Delhi, 1989.
3. J. Bonner and J. E. Varner, Plant Biochemistry. Academic Press, NewYork, 1976.
4. A.C. Deb, Fundamentals of Biochemistry. New Central Book Agency (P) Ltd., Kolkatta, 2011.
5. E.E. Conn and P.K. Stumpf, Outlines of Biochemistry. John Wiley and Sons, NewYork, 1987.
6. J. Jayaraman, Laboratory Manual in Biochemistry, Wiley Eastern Limited, New Delhi, 1895.
7. D.T. Plummer, An introduction to Practical Biochemistry. Tata Mc Graw Hill publishing Company, New Delhi, 1990.
8. J. M. Berg, J. L. Tymoczko and L. Stryer Biochemistry, W.H. Freeman Company, New York, 2012.
9. S. Palanichamy and M. Shanmugavelu, Principles of Biophysics. Palani Paramount Publications. 1996.
10. P. Narayanan, Essentials of Biophysics. New Age International Publishers, New Delhi, 2008.
11. David L. Nelson, Michael M. Cox. Lehninger Principles of Biochemistry. Seventh Edition, Macmillian UK, 2017.
12. Bhutani, S.P. 2019. Chemistry of Biomolecules. 2nd edition, CRC Press.
13. Bowsher,C. and A.Tobin 2021. Plant Biochemistry. CRC Press.

Links

1. https://www.youtube.com/watch?v=CcN8NnGGPhs
2. https://www.youtube.com/watch?v=D5RdWVBAN1c
3. https://www.youtube.com/watch?v=Ia4dkXg0C78
4. https://www.youtube.com/watch?v=c5j6ExHLFD8
5. https://www.youtube.com/watch?v=htHmxjEh4SQ

Practicals

1. Determination of neutralization point of acid-base mixture by titration method using pH meter.
2. Estimation of sugars by anthrone method - Colorimeter /Spectrophotometer.
3. Estimation of aminoacids by ninhydrin method - Colorimeter / Spectrophotometer.
4. Estimation of proteins (Lowry's method).
5. Extraction and separation of known and unknown amino acids - Paper Chromatographymethod.
6. Determination of saponification value of any two vegetable oils.
7. Determination of Km value of Nitrate Reductase enzyme.

Computer Application and Bioinformatics

Prerequisite:

Basic knowledge in Computer Operations and techniques

Objectives:

- To learn the basic applications of computer and internet
- To gain a working knowledge on computer and search strategies
- To understand the scope and application of bioinformatics

Outcome:

- Acquisition of working knowledge on computer and surfing the web
- Accumulation of knowledge in genomics and proteomics.
- Acquisition of skill in molecular docking and drug designing.
- Graduates will be able to use online databases

UNIT - I

Computer - Definition, Need for computers, Characteristics of computer- detail of input units, output units and storage devices. Classification of computers - Knowledge about windows and its scientific applications - MS Word, Power Point, Excel

UNIT – II

Internet – introduction and history, world wide web – URL – e-mail. Internet protocols – Internet service provider- Internet Browsers - Search Engines - e-books, e-journals applications of internet.

UNIT - III

Introduction to Bioinformatics - Definition, Need and Potential of Bioinformatics – Genomics and Proteomics – Human Genome Project and medically relevant genes – Pharmacoinformatics

UNIT - IV

Bioinformatics Databases: Nucleic acid sequence Databases - GenBank, EMBL, DDBJ, GSDB. Protein Sequence Databases - SwissProt, TrEMBL, PIR. Structure Databases – SCOP, PDB, CATH, CSD. Literature Databases - PubMed, Scopus.

UNIT – V

Techniques in Bioinformatics: FASTA - BLAST - Types. Pairwise and Multiple Sequence Alignment methods and significance. Molecular Visualization - JS Mol / RasMol. Prediction of Activity Spectra - PASS.

Text Books :

1. Alexis Leon and Mathews Leon, Computer Applications in Business, Vijay Nicole Imprints, Chennai, 2013.
2. S. Ignacimuthu, Basic Bioinformatics, Narosa Publishing House. New Delhi-3, 2012.
3. P. Narayanan, Bioinformatics - A Primer, New Age International Publishers, New Delhi, 2005.
4. K. Teresa, Attwood and David J. Parry-Smith, Introduction to Bioinformatics Dorling
5. Kindersley Pvt. Ltd. India, 2006.

Reference Books:

1. Alexis Leon and Mathews Leon, 2013. Computer Applications in Business, Vijay Nicole Imprints, Chennai.
2. Bryan Bergeron, Bioinformatics Computing, Prentice Hall of India, New Delhi, 2006.
3. N.Gautham, "Bioinformatics - Databases and Algorithms" Narosa Publishing House, Chennai, 2006.
4. P. Mohan, Fundamentals of Computers, Himalaya Publishing House, New Delhi, 2009.
5. P.Narayanan, Bioinformatics - A Primer, New Age International Publishers, New Delhi, 2005.
6. Neeru Mundra Renu Vashisth, Introduction to Information Technology, Himalaya Publishing House, New Delhi, 2011.
7. S.C. Rastogi, Mandiratta Namita and Rastogi Parag, Bioinformatics - Concepts, Skill Applications, CBS Publications, 2003.
8. S. Ravishankar and P.V. Raphael Computer Awareness and Applications, Himalaya Publishing House, New Delhi, 2004.
9. Saxena Sanjay, MS office for everyone, Vikas Publishing House, New Delhi, 2002.
10. T.K. Attwood and D.J. Parry-Smith, Introduction to Bioinformatics Dorling

Kindersley Pvt. Ltd. India, 2006.
11. Douglas E.Comer. The Internet Book, Chapman and Hall /CRC Press. 2018.

Links

1. https://www.youtube.com/watch?v=Q4z7pPyNGos
2. https://www.youtube.com/watch?v=RX_6nM11wGs
3. https://www.youtube.com/watch?v=4TF7VC4-4nQ
4. https://www.youtube.com/watch?v=IrHDOEDtwD4
5. https://www.youtube.com/watch?v=jV2eABoog1w

Practicals:

1. Working knowledge with computer in preparing word document, construction of line and bar graphs in Excel for the Botanical sample data provided
2. E-mail creation.
3. Searching data bases prescribed in the syllabus.
4. Sequence alignment technique – FASTA and BLAST
5. Molecular Modeling

Research Methodology and Bioinstrumentation

Prerequisite:

Basic knowledge in biological and related informations to be useful for research and development during undergraduate programme

Objectives:

- To understand the basic aspects in research
- To learn mathematical and statistical technique for research
- To acquire basic knowledge about various instruments and techniques in biological research

Outcome:

- Training and participating in active research activities for their academic and professional levels
- Creation of novel ideas and simple techniques useful to the society (R/D)
- Acquire background knowledge in research publication and thesis writing

UNIT – I

Research Methodology: Choosing the problem for research - Review of Literature - Primary, Secondary and Tertiary sources - Bibliographs - Indexing and abstracting – Reference collections - Planning and preparation of thesis. Thesis format, Journal format- Editing & Proof correction, Abstract and keywords, Full paper, Short Communication, Monographs, Review Articles, Citation, Impact Factor, Plagiarism – peer reviewed publication, Oral and Poster presentation

UNIT- II

Biostatistics: Scope, Collection and classification of data, Tabulation, Graphical and diagrammatic representation, Histograms. Standard deviation and standard error, Chi square testT test, F test, ANOVA - Application software - SPSS.

UNIT – III

Microscopy - Principles and application - Light - Dark field - Phase contrast Fluorescence - Polarization - Scanning and Transmission Electron Microscopy, Photomicrography. Cytochemical and histochemical methods- Microtomes: rotary, wood and cryo types. Microtome techniques: fixation, dehydration, clearing, embedding, sectioning staining, mounting,. Cytochemistry and detection of nucleic acids, carbohydrates, proteins and lipids in plant cells/tissue.

UNIT – IV

Study the principle and the applications of Centrifugation (High speed and Ultra), Spectroscopy (UV-Vis Spectrophotometer, AAS) and Chromatography (TLC, Column, GLC and HPLC)

UNIT –V

Electrophoresis: Basic principles, theory and applications of starch gel, agarose, PAGE, AGE.

Introduction to IPR, Types – Patent, Copyright, Trademark, Design and Trade Secret, IPR in India.

Text Books

1. N. Gurumani 2009 An introduction to Biostatistics, MJP Publishers, New Delhi.
2. N. Gurumani 2011 Research methodology in biological sciences, MJP Publishers, New Delhi

Suggested References

1. Daniel WW, 1995.Biostastics.7th edition, John Wiley and Sons, Newyork, USA.
2. Green, M. R. and Sambrook, J. 2012. Molecular Cloning: A Laboratory Manual. 4th Edition, Cold Spring Harbor Laboratory Press, Cold Spring Harbor, New York.
3. Khan, I.A. and Khanum, A. 1994. Biostatistics. Vikas Publishing House Pvt. Ltd. New Delhi.
4. Panse, V.G. and Sukhatme, P.V. 1967. Statistical Methods for Agricultural Workers. ICAR, New Delhi.
5. Plummer, D.T. 1988. An Introduction to Practical Biochemistry. Tata McGraw Hill Publishing Company. New Delhi.
6. Raghuvanshi. 1995. Practical Exercises in Cytology, Genetics, Plant Breeding and Bioststistics. CBS Publishers & Distributors, New Delhi.
7. Sandhu, G.S. 1990. Research Techniques in Biological Sciences.1st Edition. Anmol Publications, New Delhi.

8. Steel, R.G.D. and Torrie, J.H. 1960. Principles and Procedures of Statistics with special reference to Biological Sciences. McGraw-Hill.
9. Wilson, K. and Walker, J. 2000. Principles and Techniques of Practical Biochemistry. Cambridge University Press, London.
10. Balagurusamy, E. 2009. Fundamentals of Computers. Tata McGraw-Hill Education Pvt. Ltd., New Delhi.
11. Gupta, A. 2009. Instrumentation and bioanalytical techniques, Pragati Prakashan, Meerut
12. Thomas, A.P. 2009. Biology – Perspectives and methods, Green leaf Publishers, TIES. Kottayam
13. Veerakumari, L. Bioinstrumentation. 2006, MJP Publishers, Chennai
14. Uwe Flick, 2011. Introducing Research Methodology. SAGE publications.
15. Kothari C R and G.Garg 2019 Research Methodology: Methods and Technologies. New Age International Publishers.
16. Vitha M.F. 2016. Chromatography : Principles and Instrumentation. Wiley publications

Links:

1. https://www.youtube.com/watch?v=a0G7iyz4McM
2. https://www.youtube.com/watch?v=saJIWFUGEbw
3. https://www.youtube.com/watch?v=t4hhdgJADE8
4. https://www.youtube.com/watch?v=avSdoMz6OuA
3. https://www.youtube.com/watch?v=ZN7euA1fS4Y

Practicals

1. Demonstration of microscopes (Light and Dark field, phase-contrast, fluorescence, SEM, TEM). centrifugation (Ultra, high speed). TLC, UV-Vis Spectrophotometer
2. Demonstration Microtomy: preparation of thin sections and permanent slides.
3. Histochemical localisation of soluble components in plant cells - proteins, sugars, polysaccharides, lipids, nucleic acids, tannins, phenols, etc.
4. Demonstration of statistics software to analyse field data.
5. Study on Bioinstruments and Biological techniques
6. Manuscript preparation for research journal
7. Problems from Biostatistics – SD & SE , Chi-square test, T – test, F-test

Taxonomy of Angiosperms and Research Methodology and Bioinstrumentation

Taxonomy of Angiosperms

Practicals

1. Identification of plants mentioned in the syllabus
2. Preparation of dichotomous key.
3. Identification of Binomial using flora (J.S. Gamble).
4. Dissection and technical description of plants from locally available plants.
5. Workout nomenclatural problems regarding priority and author citations.

6. A study tour of Taxonomic interest (any area) – Submission of an album with 10 photographs of and 10 herbarium plant specimens from the prescribed families and field note book.

Research Methodology and Bioinstrumentation

Practicals

1. Demonstration of microscopes (Light and Dark field, phase-contrast, fluorescence,
2. SEM, TEM). centrifugation (Ultra, high speed). TLC, UV-Vis Spectrophotometer
3. Demonstration Microtomy: preparation of thin sections and permanent slides.
4. Histochemical localisation of soluble components in plant cells - proteins, sugars, polysaccharides, lipids, nucleic acids, tannins, phenols, etc.
5. Demonstration of statistics software to analyse field data.
6. Study on Bioinstruments and Biological techniques
7. Manuscript preparation for research journal
8. Problems from Biostatistics – SD & SE , Chi-square test, T – test, F-test

Biochemistry, Biophysics, Computer Application and Bioinformatics

Biochemistry and Biophysics

Practicals

1. Determination of neutralization point of acid-base mixture by titration method using pH meter.
2. Estimation of sugars by anthrone method - Colorimeter /Spectrophotometer.
3. Estimation of aminoacids by ninhydrin method - Colorimeter / Spectrophotometer.
4. Estimation of proteins (Lowry's method).
5. Extraction and separation of known and unknown amino acids – Paper Chromatography method.
6. Determination of saponification value of any two vegetable oils.
7. Determination of Km value of Nitrate Reductase enzyme.

Computer Application and Bioinformatics

Practicals:

1. Working knowledge with computer in preparing word document, construction of line and bar graphs in Excel for the Botanical sample data provided
2. E-mail creation.
3. Searching data bases prescribed in the syllabus.
4. Sequence alignment technique – FASTA and BLAST
5. Molecular Modeling