



(Bachelor of Sciences) (BOTANY)  
(B.Sc.) (Botany) Semester IV

Course Code	US04MABOT01 (T)	Title of the Course	PHYCOLOGY, MYCOLOGY AND PHYTOPATHOLOGY
Total Credits of the Course	04	Hours per Week	04

Course Objectives:	<ol style="list-style-type: none"><li>1. To make acquainted with the basic characteristic features of lower group of plants such as Algae and Fungi with suitable examples of each sub categories.</li><li>2. To give exposure for applied role and importance of such lower groups of plants.</li><li>3. To make aware for various plant pathological features of our important agricultural crops.</li></ol>
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Course Content		
Unit	Description	Weightage* (%)
1.	<b>Phycology: General characteristics</b> of Chlorophyta, Charophyta, Xanthophyta, Phaeophyta and Rhodophyta. <b>Type study:</b> <i>Vaucheria, Chlamydomonas, Chara</i> and <i>Polysiphonia</i> . (Classification (as per G. M. Smith), Occurrence, Morphology, thallus organization, Cell structure, Reproduction and life-cycle). Significant contributions of renowned Phycologists (F.E. Fritsch, G.M. Smith, R.N. Singh, T.V. Desikachary, H.D. Kumar).	25%
2.	<b>Introduction to true fungi</b> General characteristics; Affinities with plants and animals; <b>Mycology: General Characteristic</b> features of Chytridiomycota, Oomycota, Zygomycota, Ascomycota, Basidiomycota. <b>Type study:</b> <i>Phytophthora, Albugo, Aspergillus, Neurospora</i> ,. (Classification (as per G. C. Ainsworth, 1973), Occurrence, Morphology, thallus organization, Cell structure, Reproduction and life-cycle).	25%
3.	<b>Plant Pathology:</b> <ul style="list-style-type: none"><li>• Introduction</li><li>• Pathogenesis</li><li>• Effect of infection on host physiology</li><li>• Host resistance</li><li>• General symptoms and classification of plant diseases</li></ul>	25%
4.	<b>Phytopathology:</b> <b>Major Plant Diseases:</b> Differentiation between bacterial, viral and	25%





	<p>fungal diseases using morphological symptoms.          Study of the following diseases (symptoms, causal organism, disease cycle and disease control).  <b>Bacterial diseases</b> – Citrus Canker, Angular leaf spot of cotton.  <b>Viral diseases</b> -Leaf curl of papaya, Yellow vein mosaic in bhindi.  <b>Fungal diseases</b>- White rust of crucifers, Red rot of sugarcane, Tikka disease of groundnut, and Stripe rust of wheat.  <b>Phytoplasma diseases:</b> Little leaf of brinjal.          Significant contributions of Prof.Karam Chand Mehta.</p>	
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Teaching-Learning Methodology	<p>Classroom interactions          Multimedia presentation          Chart/model presentation          Live /preserved specimen observation          Student seminar and unit test, quiz etc          Question bank circulation          Student’s assignments          Student counselling for any problem of subject understanding          Student-Teacher interaction on social media platform for any query (MS team, Google classroom, email, etc)</p>
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Evaluation Pattern		
Sr. No.	Details of the Evaluation	Weightage
1.	Internal Written / Practical Examination (As per CBCS R.6.8.3)	50%
2.	Internal Continuous Assessment in the form of Practical, Viva-voce, Quizzes, Seminars, Assignments, Attendance (As per CBCS R.6.8.3)	
3.	University Examination	50%

Course Outcomes: Having completed this course, the learner will be able to	
1.	Identify true fungi and demonstrate the principles and application of plant pathology in the control of plant disease.
2.	Demonstrate skills in laboratory, field and glasshouse work related to mycology and plant pathology
3.	Develop an understanding of microbes, fungi and lichens and appreciate their adaptive strategies
4.	Identify the common plant diseases according to geographical locations and device control measures





Suggested References:

Sr. No.	References
1.	A TEXT BOOK OF BOTANY,SINGH,PANDE AND JAIN
2.	Agrios, G.N. (1997) Plant Pathology, 4th edition, Academic Press, U.K.
3.	Alexopoulos, C.J., Mims, C.W., Blackwell, M. (1996).
4.	R.S.Mehrotra,Plant Pathology
5.	B. R. Vashistha, Fungi
6.	Gangulee and Kar, College Botany Vol 2
7.	John Wiley & Sons, Introductory Mycology, (Asia) Singapore. 4th edition.
8.	Sethi, I.K. and Walia, S.K. (2011). Text book of Fungi and Their Allies, Macmillan Publishers India Ltd.
9.	Sharma, P.D. (2011). Plant Pathology, Rastogi Publication, Meerut, India. Kumar, H.D. (1999).
10.	Singh R. S. Plant Pathology
11.	Webster, J. and Weber, R. (2007). Introduction to Fungi, Cambridge University Press, Cambridge. 3rd edition.

On-line resources to be used if available as reference material

<https://www.biologydiscussion.com/biologyarticles>

<https://nlist.inflibnet.ac.in/> e books/e-journals

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(Bachelor of Sciences) (Botany)  
(B.Sc.) (Botany) Semester (IV)

Course Code	US04MABOT02(T)	Title of the Course	GENETICS AND BIOINFORMATICS
Total Credits of the Course	04	Hours per Week	04

Course Objectives:	<ol style="list-style-type: none"><li>1. To learn life cycles of genetically important organisms</li><li>2. To know about mendelism and its extension</li><li>3. To have an idea about linkage, crossing over and Cytoplasmic inheritance</li><li>4. A student completing shall be able to apply: knowledge and awareness of the basic principles and concepts of biology, computer science and mathematics. existing software effectively to extract information from large databases and to use this information in computer modelling</li></ol>
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Course Content		
Unit	Description	Weightage* (%)
1.	<b>Genetics:</b> Introduction: Definition, scope, branches and application of genetics, selection of genetic material, Profiles of some geneticists and molecular biologists, Life cycle of some genetically important organisms like Bacteriophage, E. Coli, Yeast, Neurospora, Chlamydomonas, Maize and Arabidopsis.	25%
2.	<b>Mendelian genetics and its extension</b> Mendelism: History; Principles of inheritance; Chromosome theory of inheritance; Autosomes and sex chromosomes; Incomplete dominance and codominance; Multiple alleles, Lethal alleles, Epistasis, Pleiotropy, Recessive and Dominant traits, Penetrance and Expressivity, Polygenic inheritance.	25%
3.	<b>Genetics:</b> Linkage-Definition, History, Kinds, Linkage groups and significance. Crossing Over-Definition, Types, Mechanism, Kinds and significance. Maternal effects and cytoplasmic inheritance: Maternal effects in snails, Streptomycin resistance in Chlamydomonas, mitochondrial mutations in yeast, Kappa particles in <i>Paramecium</i> , plastid inheritance in <i>Mirabilis jalapa</i> , male sterility in plants.	25%
4.	<b>Introduction to Bioinformatics:</b> <b>Introduction:</b> What is bioinformatics? Definition, A multidisciplinary approach, Branches of Bioinformatics, History, Aim, Scope and Research areas of Bioinformatics, applications of bioinformatics. Bioinformatics in India-the flourishing approach.	25%





	<b>Databases in Bioinformatics:</b> Introduction, Biological Databases, Classification, format of Biological Databases, Biological Database Retrieval System.	
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<b>Teaching-Learning Methodology</b>	Classroom interactions Multimedia presentation Chart/model presentation Live /preserved specimen observation Student seminar and unit test, quiz etc Question bank circulation Students' assignments Student counselling for any problem of subject understanding Student-Teacher interaction on social media platform for any query (MS team, Google classroom, email, etc)
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Evaluation Pattern		
Sr. No.	Details of the Evaluation	Weightage
1.	Internal Written / Practical Examination (As per CBCS R.6.8.3)	50%
2.	Internal Continuous Assessment in the form of Practical, Viva-voce, Quizzes, Seminars, Assignments, Attendance (As per CBCS R.6.8.3)	
3.	University Examination	50%

Course Outcomes: Having completed this course, the learner will be able to	
1.	Have conceptual understanding of laws of inheritance, genetic basis of loci and alleles and their linkage.
2.	Develop critical understanding of chemical basis of genes and their interactions at population and evolutionary levels.
3.	Basic concept and life cycle of genetically important organisms.
4.	Learn about Introductory Bioinformatics and its databases.





Suggested References:

Sr. No.	References
1.	Klug, W.S., Cummings, M.R., Spencer, C.A. (2009). Concepts of Genetics. Benjamin Cummings, U.S.A. 9th edition.
2.	Verma and Agarwal, 9th edition GENETICS
3.	Gardner, E.J., Simmons, M.J., Snustad, D.P. (1991). Principles of Genetics, John Wiley & sons, India. 8th edition
4.	Watson J. D., Baker, T. A., Bell, S. P., Gann, A., Levine, M., Losick, R. (2007). Molecular Biology of the Gene, Pearson Benjamin Cummings, CSHL Press, New York, U.S.A. 6th edition.
5.	Sharma, Munjal and Shankar, A Text book of Bioinformatics (Rastogi publication)

On-line resources to be used if available as reference material

<https://www.biologydiscussion.com/biologyarticles>

<https://nlist.inflibnet.ac.in/> e books/e-journals

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**(Bachelor of Sciences) (Botany)**  
**(B.Sc.) (Botany) Semester (IV)**

Course Code	<b>US04MABOT03 (P)</b>	Title of the Course	<b>BOTANY PRACTICAL</b>
Total Credits of the Course	<b>04</b>	Hours per Week	<b>08</b>

Course Objectives:	1. To get hands on training to use various botany laboratory equipment. 2. To do experiment as per the given syllabus through fresh/preserved specimen/slides/models/charts etc
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<b>Course content [equal Weightage (%) for each practical]</b>	
No.	AIM
<b>SECTION-I CREDIT-2 PRACTICAL-4 HOUR</b>	
1.	Study of <i>Vaucheria</i> (Classification, Thallus morphology, reproduction through mounting or permanent slides/charts/photographs).
2.	Study of <i>Chlamydomonas</i> and <i>Chara</i> (Classification, Thallus morphology, reproduction through mounting or permanent slides/charts/photographs).
3.	Study of <i>Polysiphonia</i> (Classification, Thallus morphology, reproduction through mounting or permanent slides/charts/photographs).
4.	Study of <i>Aspergillus</i> and <i>Neurospora, Alternaria</i> . Classification, Thallus morphology, and reproduction (through mounting/permanent slides/charts/photographs).
5.	Study of white rust of crucifers (specimen showing symptoms on plant parts, causal organisms through sectioning and or permanent slides/charts/photographs).
6.	Study of early blight of potato (specimen showing symptoms on plant parts, causal organisms through sectioning and or permanent slides/charts/photographs).
7.	Study of late blight of potato (specimen showing symptoms on plant parts, causal organisms through sectioning and or permanent slides/charts/photographs)
8.	Study of Rust of wheat (specimen showing symptoms on plant parts, causal organisms through sectioning and or permanent slides/charts/photographs).
9.	Study of Tikka disease of ground nut (specimen showing symptoms on plant parts, causal organisms through sectioning and or permanent slides/charts/photographs).
10	Preparation of potato dextrose culture medium and slants and To enumerate the steps involved for Culturing of fungi.
11	Submission of disease specimens.
<b>SECTION-II CREDIT-2 PRACTICAL-4 HOUR</b>	
1.	Exploration of the resources available in NCBI
2.	Study of Primary databases.
3.	Retrieval of a Genbank Entry using an accession number
4.	Retrieval and analysis of a gene sequence "AF375082" in FASTA format
5.	Finding the official Symbol, alias name, chromosome number and ID for gene using NCBI
6.	Retrieval and analysis of a protein sequence from protein database





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7.	Meiosis through temporary squash preparation/permanent slides/photographs.
8.	Mendel's laws through seed ratios and related problems. Laboratory exercises in probability and chi-square based on Mendelism.
9.	Study of important geneticist.
10.	To study life cycle of genetically important organisms like Arabidopsis, Maize, etc
11.	Field activity related to syllabus.

Evaluation Pattern		
Sr. No.	Details of the Evaluation	Weightage
1.	Internal Examination	50%
2.	University Examination	50%

Course Outcomes: Having completed this course, the learner in the laboratory course, will be able to	
1.	Gain hands-on experience of using various optical instruments and making temporary mountings.
2.	Identifying various pathogens for plant diseases.
3.	Study the characteristics of algae, fungi and lichens.
4.	Study the characteristics of some selected plant families and their economic role through specimens/charts/field specimens.
5.	Carried out field visits to explore ecological understanding and learn range of biodiversity and introductory information about bioinformatics.

Suggested References:	
Sr. No.	References
1.	Practical botany Vol 1 and 2 Ashok Kumar Bendre
2.	BIOINFORMATICS <i>For Beginners</i> LABORATORY MANUAL published by BLUE HILL PUBLISHERS

On-line resources to be used if available as reference material
<a href="https://www.biologydiscussion.com/biologyarticles">https://www.biologydiscussion.com/biologyarticles</a>
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(Bachelor Of Science) (Botany)  
(B.Sc.) (Botany-Minor) Semester (IV)

Course Code	US04MIBOT01	Title of the Course	PLANT MORPHOLOGY AND TAXONOMY
Total Credits of the Course	02	Hours per Week	02

Course Objectives:	1.To study morphology of angiosperm plants. 2.To learn technical terms to describe morphological features. 3.To learn how to describe an angiosperm plant in a technical language.
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Course Content		
Unit	Description	Weightage* (%)
1.	<b>Introduction to Plant Morphology:</b> Importance of plant morphology, Parts of an angiosperm plant. <b>Morphology of Leaf:</b> Parts of a leaf, types of leaves, types of stipules and their modifications, leaf blade with ref. to apex, margin, and shape. Venation, Simple and compound leaves, Modifications of leaves, Phyllotaxy, Functions of leaves. <b>The Inflorescence:</b> Definition, Classification of inflorescences, Racemose and its types, Cymose and its types and special types of inflorescence.	50
2.	<b>The Flower:</b> <b>Flower</b> as a modified shoot, structure of flower, types of flower, thalamus, bracts, Symmetry of the flower, <b>Calyx and corolla:</b> its modifications and forms. <b>Androecium:</b> Parts of stamen, cohesion of stamens, adhesion of stamens, length of stamens, <b>Gynoecium:</b> Parts of carpel, simple and compound gynoecium, cohesion of carpels, placentation and its types. <b>The Fruit:</b> Definition, Parts of fruit, Classification of fruits with suitable examples.. <b>The Seed:</b> Definition, Parts of dicotyledonous and monocotyledonous seeds, Seed germination and its types. How to describe an angiosperm plant? -General characters with economic importance of the following families: Malvaceae, Solanaceae And Euphorbiaceae	50





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Teaching-Learning Methodology	Classroom interactions Multimedia presentation Chart/model presentation Live /preserved specimen observation Student seminar and unit test, quiz etc Question bank circulation Students assignments Student counselling for any problem of subject understanding Student-Teacher interaction on social media platform for any query (MS team, Google classroom, email, etc)
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Evaluation Pattern		
Sr. No.	Details of the Evaluation	Weightage
1.	Internal Written / (As per CBCS R.6.8.3)	50%
2.	Internal Continuous Assessment in the form of Practical, Viva-voce, Quizzes, Seminars, Assignments, Attendance (As per CBCS R.6.8.3)	
3.	University Examination	50%

Course Outcomes: Having completed this course, the learner will be able to	
1.	Understand plant morphology
2.	Understand basics of floral morphology
3.	Understand how plant morphology relates to plant reproduction
4.	Understand significance of morphological modifications of plant parts
5.	Have foundation for a course on Plant Systematics





Suggested References:

Sr. No.	References
1.	Botany for Degree Students, A.C.Dutta, Oxford University Press
2.	Taxonomy of Angiosperms, V. Singh and D. K. Jain, Rastogi Publications
3.	A Text Book of Botany- Angiosperms, B. P. Pandey, S. Chand and Comp. Ltd
4.	A Text Book of Practical Botany II, Ashok Bendre and Ashok Kumar, Rastogi Publication
5.	Morphology and Economic Botany of Angiosperms, S SundararRajan, Anmol Publications Pvt Ltd

On-line resources to be used if available as reference material

Shodhganga

<https://onlinelibrary.wiley.com/doi/book/10.1002/9781444313383>

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(Bachelor of Sciences) (Botany)  
 (B.Sc.) (Botany-Minor) Semester (IV)

Course Code	US04MIBOT02	Title of the Course	Practical
Total Credits of the Course	02	Hours per Week	04

Course Objectives:	1. To get hands on training to use various biology laboratory equipment. 2. To do experiment as per the given syllabus through fresh/preserved specimen/slides/models/charts etc
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No	Practical
1.	Study of leaf and its modifications (stipules, venation, simple leaf and types of compound leaves, leaf shapes, leaf margins, leaf apices)
2.	Study of Phyllotaxy (Distichous, tristichous, penta-stichous, opposite decussate, opposite superposed, whorled)
3.	Study of Inflorescences (Racemose, cymose, special types)
4.	Study of flowers (Bract and bracteoles, attachment of flower, presence of floral whorls, symmetry, presence of reproductive organs, number of floral parts, position of floral organs on thalamus, perianth, tepals, aestivation)
5.	Study of Androecium, Gynoecium and placentation and types of fruits.
6.	Study the Signs and symbols to construct floral formula and draw floral diagram.
7.	Taxonomical study of plants belongs to families as mentioned below: Malvaceae
8.	Solanaceae
9.	Euphorbiaceae
10.	<b>Botanical excursion</b> (Students are expected to visit nearby forest area or area of botanical interest for field experience. Prepare the excursion report and submit

Teaching-Learning Methodology	Observation of specimen Handling of specimen Using student's microscope Using certain required chemical for test Dissection of specimen Preparing journal through drawing various figures with description Learn through charts/model Field visits for live experience. Preparing field visit note.
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Evaluation Pattern		
Sr. No.	Details of the Evaluation	Weightage
1	Internal Examination	50%
2	University Examination	50%

Course Outcomes: Having completed this course, the learner will be able to	
1.	Gain hands-on experience of using various optical instruments and making temporary mountings.
2.	Identifying various plant specimen through mountings of fresh specimens/charts/models.
3.	Understand characteristics of biological specimens.
4.	Carried out field visits to explore ecological understanding and learn range of biodiversity.

Suggested References:	
Sr. No.	References
1.	A text book of Practical Botany(vol I&II) by Bendre and Kumar
2.	Modern Practical Botany(vol I&II)byPandey B.P.
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On-line resources to be used if available as reference material
On-line Resources
The virtual library of Botany
<a href="https://www.wiziq.com/tutorials/practical">https://www.wiziq.com/tutorials/practical</a>

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(Bachelor Of Sciences) (Botany)  
(B.Sc.) (Botany-SEC) Semester (IV)

Course Code	US04SEBOT01	Title of the Course	HYDROPONICS-2
Total Credits of the Course	02	Hours per Week	02

Course Objectives:	<ol style="list-style-type: none"><li>1. Basic knowledge on Hydroponic systems ; aware on Hydroponic materials (media, etc.)</li><li>2. Working with Hydroponic equipments.</li><li>3. Basic knowledge on Nutrition management.</li><li>4. Hydroponic greenhouse management; basic knowledge on Hydroponic crops.</li></ol>
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Course Content		
Unit	Description	Weightage* (%)
1.	Nutrient Solutions and Media: Inorganic salts (fertilizers)-Macronutrients, Micronutrients, Formulating, monitoring, and analyzing, Plant Nutrition, pH adjustment, selecting fertilizers and nutrient monitoring; Media used for Hydroponics: Ex-clay, Rock wool, Coir, Perlite, Pumice, Vermiculite, Sand, Gravel, Brick shards, Polystyrene packing peanuts, wood fiber; Weed management, diseases and pest control, Pollination, making clones of plants.	50
2.	Techniques in Hydroponics and Cultivation of crop plants: Techniques in Hydroponics – Static solution culture, Continuous – flow Solution culture, Aeroponics, Passive sub-irrigation, Ebb and flow or flood and drain irrigation, Deep water culture; Protocols for – Tomato cultivation through Dutch bucket method, Chilly cultivation through NFT system, Spinach through Raft system , Fodder system.	50

Teaching-Learning Methodology	<p>Classroom interactions Multimedia presentation Chart/model presentation/Garden visit Live /preserved specimen observation Student seminar and unit test, quiz etc Question bank circulation Students assignments Student counselling for any problem of subject understanding Student-Teacher interaction on social media platform for any query (MS team, Google classroom, email, etc)</p>
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Evaluation Pattern		
Sr. No.	Details of the Evaluation	Weightage
1.	Internal Written / Practical Examination (As per CBCS R.6.8.3)	50%
2.	Internal Continuous Assessment in the form of Practical, Viva-voce, Quizzes, Seminars, Assignments, Attendance (As per CBCS R.6.8.3)	
3.	University Examination	50%

Course Outcomes: Having completed this course, the learner will be able to	
1.	Describe the advantages/disadvantages of controlled environment agriculture and hydroponic crop production in the agricultural production of various food crops.
2.	Demonstrate an understanding of basic principles of plant biology, entomology, plant nutrition and disorders, irrigation and fertilization, and environmental conditions necessary for growing greenhouse hydroponic vegetable crops.
3.	Understand plant cultivation, harvesting, pest management, and food safety techniques for growing hydroponic tomatoes; understand the considerations involved with different types of greenhouses and structural components, control systems, and site selection in order to grow a successful crop.
4.	Understand the knowledge base, food safety issues, marketing, and financial considerations needed to start a hydroponic crop production business.

Suggested References:	
Sr. No.	References
1.	Howard M. Resh. Hobby Hydroponics. CRC Press USA.
2.	Keith Roberto. How to Hydroponics. The future garden press New York. 4th Edition.
3.	Prasad S and Kumar U. Green House Management for Horticultural Crops. Agrobios India
4.	Dahama A K. Organic Farming for Sustainable Agriculture. Agrobios India.
On-line resources to be used if available as reference	
On-line Resources	
Google	

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