

ST. JOSEPH'S COLLEGE (AUTONOMOUS)

BENGALURU-27



Re-accredited with 'A++' GRADE with 3.79/4 CGPA by NAAC
Recognized by UGC as College of Excellence

DEPARTMENT OF BOTANY

SYLLABUS FOR UNDERGRADUATE PROGRAMME

For Batch 2021-2024

Part B

B.Sc. CBZ Curriculum (CEB, MCB, CBBt, BZBc)

Courses and course completion requirements	No. of credits
General English	12
Second language: Introductory Kannada/Kannada/ Hindi/ Sanskrit/ Tamil/ Additional English/French/German.	12
Botany	38
Chemistry	
Zoology	
Microbiology	
Biotechnology	
Biochemistry	
Environmental science	
Open elective courses (non-professional)	
Foundation courses	
Term paper	
Soft skills (IGNITORS)	
Human resource development (HRD)/Theology	
Outreach activity	
Extra and Co-curricular activities	5

SUMMARY OF CREDITS IN BOTANY

DEPARTMENT OF BOTANY (UG)								
(2021-2024)								
Semester 1	Code Number	Title	No. of Hours of Instructions	Number of Hours of teaching per week	Number of credits	Continuous Internal Assessment (CIA) Marks	End Semester Marks	Total marks
Theory	BO-121	Microbiology and Algae	60	04	04	30	70	100
Practical	BO-1P1	Microbiology and Algae	33	03	1.5	15	35	50
Total Number of credits:			5.5					
Semester 2	Code Number	Title	No. of Hours of Instructions	Number of teaching hrs /week	Number of credits	Continuous Internal Assessment (CIA) Marks	End Semester Marks	Total marks
Theory	BO-221	Fungi, Plant Pathology, Bryophytes and Anatomy	60	04	04	30	70	100
Practical	BO-2P1	Fungi, Plant Pathology, Bryophytes and Anatomy	33	03	1.5	15	35	50
Total Number of credits:			5.5					
Semester 3	Code Number	Title	No. of Hours of Instructions	Number of teaching hrs /week	Number of credits	Continuous Internal Assessment (CIA) Marks	End Semester Marks	Total marks
Theory	BO-321	Pteridophytes, Gymnosperms and Paleobotany	60	04	04	30	70	100
Practical	BO-3P1	Pteridophytes, Gymnosperms and Paleobotany	33	03	1.5	15	35	50
Total Number of credits:			5.5					
Semester 4	Code Number	Title	No. of Hours of Instructions	Number of teaching hrs /week	Number of credits	Continuous Internal Assessment (CIA) Marks	End Semester Marks	Total marks
Theory	BO-421	Embryology of Angiosperms, Palynology and Environmental Biology	30	02	02	15	35	50
Practical	BO-4P1	Embryology of Angiosperms, Palynology and Environmental Biology	33	03	1.5	15	35	50
Theory (OE)	BOOE-4121	Applied Botany (CBCS- Interdepartmental Elective)	30	02	02	15	35	50
Total Number of credits:			3.5					

Semester 5	Code Number	Title	No. of Hours of Instructions	Number of teaching hrs /week	Number of credits	Continuous Internal Assessment (CIA) Marks	End Semester Marks	Total marks
Theory	BO-5121	Taxonomy of Angiosperms and Economic Botany	45	03	03	30	70	100
Practical	BO-5P1	Taxonomy of Angiosperms and Economic Botany	33	03	1.5	15	35	50
Theory	BO-5221	Molecular Biology and Plant Biotechnology	45	03	03	30	70	100
Practical	BO-5P2	Molecular Biology and Plant Biotechnology	33	03	1.5	15	35	50
Total Number of credits:					09			
Semester 6	Code Number	Title	No. of Hours of Instructions	Number of teaching hrs /week	Number of credits	Continuous Internal Assessment (CIA) Marks	End Semester Marks	Total marks
Theory	BO-6121	Plant physiology	45	03	03	30	70	100
Practical	BO-6P1	Plant physiology	33	03	1.5	15	35	50
Theory	BO-6221	Cytology, Genetics, Plant breeding & Propagation	45	03	03	30	70	100
Practical	BO-6P2	Cytology, Genetics, Plant breeding & Propagation	33	03	1.5	15	35	50
Total Number of credits:					09			

CORE COURSES (CC)	
Course Title	Code Number
Microbiology and Algae	BO-121

DISCIPLINE SPECIFIC ELECTIVE COURSES (DSE)	
Course Title	Code Number

GENERIC ELECTIVE COURSES (GSE)/ Can include open electives offered	
Course Title	Code Number
Applied Botany	BOOE- 4121

SKILL ENHANCEMENT COURSE (SEC) – Any practical oriented and software based courses offered by departments to be listed below	
Course Title	Code Number
Microbiology and Algae	BO1P1

VALUE ADDED COURSES (VAC) Certificate courses that add value to the core papers can be listed	
Course Title	Code Number
Clinical Research and Data Management	

Online courses offered or recommended by the department to be listed	
Course Title	Code Number

Course Outcomes and Course Content

Semester	I
Paper Code	BO 121
Paper Title	Microbiology and Algae
Number of teaching hours per week	04
Total number of teaching hours per semester	60
Number of credits	04

Objective of the Paper:

- To understand basic concepts of Microbiology
- To know the different characteristics of viruses, bacteria, mycoplasma and algae and to appreciate the significance of each of them
- To gain a basic understanding of response of the immune system to microbes
- To appreciate the diversity and uses of algae

BO-121: Microbiology and Algae

Unit I	<p>Microbiology: <i>Historical account of microbiology, Brief contributions of Anton van Leeuwenhoek, Louis Pasteur, Robert Koch, Edward Jenner and Alexander Flemming. Scope of Microbiology (Unit I - Self study)</i></p>	2 hrs
Unit II	<p>Viruses: General characteristics, classification based on genetic material; Structure and multiplication of CMV, TMV.</p> <p>Plant Immune Response: Physical barriers in plants. Plant responses to Viruses, Fungi & Bacteria. Plantibodies. Brief account of Viroids and prions.</p>	11 hrs
Unit III	<p>Bacteria: <i>General characteristics of bacteria (self study)</i> Physical and chemical structure of Gram positive and Gram negative bacterial cell walls. Structure of capsule, flagella, pili and endospore. (Ultrastructure of flagella and endospore only) Reproduction by binary fission. Genetic recombination by conjugation (F+ and F-, Hfr types), Transduction (generalized and specialized types) and Transformation. A brief account of transposons. <i>A brief account of importance of bacteria in agriculture, industry, medicine and environment. (self study)</i></p>	9 + 3 hrs

Unit IV	Mycoplasma: General characteristics, structure, reproduction and its significance.	2 hrs
Unit V	Cyanobacteria: General characters, Structure and reproduction of <i>Anabaena</i> , <i>Scytonema</i> , <i>Spirulina</i> . <i>Economic importance of Cyanobacteria. (self study)</i>	3 + 1 hrs
Unit VI	Diversity of Algae: Habitat, thallus organization and reproduction ; Life cycles in algae: Haplontic, diplontic, haplobiontic and diplobiontic types	13 hrs
Unit VII	Systematic position, structure and reproduction of the following forms: (a) <i>Volvox</i> , (b) <i>Hydrodictyon</i> , (c) <i>Spirogyra</i> , (d) <i>Chara</i> (e) <i>Vaucheria</i> , (f) <i>Sargassum</i> , (g) <i>Batrachospermum</i>	15 hrs
Unit VIII	<i>Economic importance of algae (Self study).</i>	1 hr

NOTE: 8 hours of self-study has been assigned.

REFERENCES

- Smith G.M. 1955. Cryptogamic Botany Vol 1., Kogakusha company Ltd., Japan.
- Vashishta B.R. 1976. Botany for degree students Part 1. Algae. S. Chand and company, New Delhi.
- Kumar H.D. 1990. Introductory Phycology. East Western Press, New Delhi.
- Srivastava H.N. 1998. Algae. Pradeep publications, Jalandar
- Sundarajan,S.1998 College Microbiology Vol 1.,Vardhana publications, Bangalore.
- Pelezar M.J. JR, Chan E.C.S and Krieg N.R. 2005. Microbiology, Tata McGraw Hill pub. Co. Ltd., New Delhi.
- Chopra, G.L.1973, Text Book of Algae, S. Nagin and Co. Jalandhar.
- Schlegel H.G. 1993. General Microbiology, VII Ed. Cambridge. Univ. Press, England.
- Volk and Wheeler, 1980, Basic Microbiology IV Ed. J.B. Lippincott Company, Philadelphia.
- Benson, H.J. 1990. Microbiological Applications, A Laboratory Manual in General Microbiology, Wm.C. Brown Publishers.
- Powar, C.B. and Dagainawala, 1991. General Microbiology Vol.I & II, Himalaya publishing company, Mumbai.
- Bold and Wynne, 1985. Introduction to Algae - Structure and Reproduction. Prenticehall, India.
- Fritsch, F.E. 1961. Structure and Reproduction in Algae, Vol. I and II, Cambridge University Press, London.
- Trivedi, P.C. 2001. Algal Biotechnology, Pointer publishers, Jaipur, India.
- Tortora G.J., Funke B.R. and Case C.L. 1998, Microbiology an Introduction, 6th Ed. Addison Wesley Longman, Inc. USA
- Dubey, R.C. and Maheshwari, D.K. 2007. A Text book of Microbiology, S Chand and Company, New Delhi.
- Satish C Bhatla, Manju A. Lal - Plant Physiology & Metabolism <https://doi.org/10.1007/978-981-13-2023-1>.
- Oluwayelu, Daniel O., and Adebawale I. Adebisi. "Plantibodies in human and animal health: a review." African health sciences 16.2 (2016): 640-645.

BLUEPRINT

Code number: **BO 121**

Title of the paper: **Microbiology and Algae**

Chapter	Number of Hours	Total marks for which the questions are to be asked (including bonus questions)
Unit I	02	03
Unit II	10	16
Unit III	12	19
Unit IV	02	03
Unit V	04	06
Unit VI	13	22
Unit VII	15	24
Unit VIII	02	03
TOTAL	60	96
Maximum marks for the paper (Excluding bonus question)= 70		

Practical I: BO 1P1 – Microbiology and Algae

33 Hours (11 sessions, 3hr/week)

1. Gram staining of bacteria (*Rhizobium*, *Lactobacillus*).
2. Haemocytometry (Yeast).
3. Demonstration of motility in bacteria by hanging drop technique.
4. Study of Cyanobacterial forms: *Anabaena*, *Scytonema*, *Spirulina*.
5. Algae-Study of morphology and reproduction of forms studied in theory.
6. Study of algae in natural habitats.

Course Outcomes: At the end of the course, the student should

CO1	Appreciate the world of microbes and apply basic techniques like Gram's staining for bacterial identification
CO2	Understand structure, functioning and life cycle of viruses, bacteria and algae
CO3	Appreciate economic importance of the above mentioned groups
CO4	Able to identify Gram positive and negative bacteria, and also some algal forms
CO5	
CO6	

Course Outcomes and Course Content

Semester	II
Paper Code	BO 221
Paper Title	Fungi, Plant Pathology, Bryophytes and Anatomy
Number of teaching hours per week	04
Total number of teaching hours per semester	60
Number of credits	04

Objective of the Paper:

Plants, to most people, mean a wide range of living organisms from the smallest bacteria to the largest living things - the giant sequoia trees. By this definition plants include: algae, fungi, lichens, mosses, ferns, conifers and flowering plants. To understand the identification techniques, naming and classification of Fungi and Bryophytes. To apply learnt concepts in fungi and Plant Pathology for the exploration of useful and harmful Fungi. To study diverse plant pathogens, symptoms, Plant diseases and their control will be applied in Agriculture and Food Security To study and understand morphological, internal structure of diverse plant groups for the evolution of structure-functions and their application.

Unit I	<p>Fungi</p> <p>General characteristics, habitat, structure and reproduction of fungi</p> <p>Outline of classification according to Alexopoulos et al. 1996</p> <p>Detailed study of morphology and reproduction of following Fungal Forms: <i>Stemonitis, Pythium, Aspergillus, Peziza, Puccinia, Lycoperdon, Agaricus and Cercospora.</i></p> <p>Mycorrhizae and their significance</p> <p><i>General account of Lichens, Economic importance of fungi (self study)</i></p>	<p>15 + 2 hrs</p> <p>3</p> <p>1</p> <p>10</p> <p>1</p> <p>2</p>
Unit II	<p>Plant pathology</p> <p>Plant Disease and Disease cycle, classification of Diseases based on symptoms</p> <p>Study of Etiology, disease symptoms, vectors if any, disease cycle and control measures of following diseases: Tomato Leaf Curl, Citrus Canker, Sandal Spike, Club Root of Crucifer, Late Blight of Potato, Smut of Jowar, Blast of Rice, Red Rot of Sugarcane,</p> <p><i>Any two disease above as (self study)</i></p>	<p>11 + 2 hrs</p> <p>3</p> <p>8</p> <p>2</p>

Unit III	Bryophytes <i>Distribution, General characters. (self study)</i> Alternation of generation and Classification of Bryophytes. Salient features of class: Hepaticopsida, Anthocerotopsida, and Bryopsida Morphology, anatomy and reproduction of <i>Marchantia</i> , <i>Anthoceros</i> , <i>Funaria</i> (developmental details not required). Economic importance of Bryophytes.	14 + 1 hrs 1 2 5 6 1
Unit IV	Anatomy Meristems and their classification, Shoot Apical Meristem (SAM), Root Apical Meristem (RAM) in <i>Arabidopsis</i> , Cytohistological zonation. Secretory tissues - Types, structure and importance Secondary Growth in dicot stem and dicot root. Anomalous secondary growth in stem of <i>Boerhaavia</i> and <i>Dracaena</i> . Wood anatomy: Variation in wood structure: ring porous and diffuse porous, Wood parenchyma, uniseriate and multiseriate rays, apotracheal and paratracheal parenchyma <i>Primary structure of root and stem (self study)</i>	12 + 3 hrs 3 2 4 3 3

NOTE: 8 hours of self-study has been assigned.

REFERENCES:

- Dube H.C. 2015. An Introduction of Fungi, IV Edition, Scientific publishers, India.
- Mehrotra R.S & K.R. Aneja. 1990. An introduction to Mycology. New age international publishers, New Delhi.
- Vasishtha B.R. 1981. Botany for degree students Part II, Fungi. S. Chand company
- Srivastava H.N. 1993. Fungi, Predeep Publications, Allahabad
- Bilgrami K.S and Dube H.C. 1976. A Text book of Modern Plant Pathology. Vikas Publication House, New Delhi.
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- Easu K. 1979. Anatomy of Seed Plants. Wiley Eastern Ltd. New Delhi.
- Singh R.S. 1984. Introduction to Principles of Plant Pathology, Oxford and IBH Publication Co. Pvt. Ltd. New Delhi.
- Sundararajan S. 1993. College Botany, Vol I & II. Himalaya Publishing Company. Bangalore
- Alexopoulos C.J., Mims, C.W and Blackwell, M. 1996. Introduction to Mycology, Wiley Eastern Ltd., New Delhi.

BLUE PRINT

Code number: BO 221

Title of the paper: Fungi, Plant Pathology, Bryophytes and Anatomy

Chapter	Number of Hours	Total marks for which the questions are to be asked (including bonus questions)
Unit I	17	27
Unit II	13	21
Unit III	15	24
Unit IV	15	24
TOTAL	60	96
Maximum marks for the paper (Excluding bonus question)= 70		

Practical II: BO 2P1- Fungi, Plant Pathology, Bryophytes and Anatomy

Total: 33 Hours (11 sessions, 3hr/week)

1. Study of *Stemonitis*, *Pythium*, *Aspergillus*, *Peziza*, *Puccinia*, *Lycoperdon*, *Agaricus* and *Cercospora*.
2. Lichens, Mycorrhizae (Ecto, VAM only).
3. Plant diseases: Tomato Leaf Curl, Citrus Canker, Sandal Spike, Club Root of Crucifer, Late blight of Potato, Smut of Jowar, Blast of Rice, Red Rot of Sugarcane.
4. Study of *Marchantia*, *Anthoceros* and *Funaria*.
5. Anatomy of dicot and monocot stem and root (both primary and secondary).
6. Anomalous secondary growth in *Boerhaavia* and *Dracaena*
7. Student's submission: 3 Herbarium sheets of diseased plants.

REFERENCES:

- Dube H.C. 2015. An Introduction of Fungi, IV Edition, Scientific publishers, India.
- Mehrotra R.S & K.R. Aneja. 1990. An introduction to Mycology. New age international publishers, New Delhi.
- Esau K. 1979. Anatomy of Seed Plants. Wiley Eastern Ltd. New Delhi.
- Singh R. S. 1984. Introduction to Principles of Plant Pathology, Oxford and IBH Publication Co. Pvt. Ltd. New Delhi.

Course Outcomes: At the end of the Course, the Students

CO1	Have developed a good knowledge of the history, development and scope of the discipline of fungi, Plant Pathology Bryophytes, and Plant Anatomy and the contributions made by prominent scientists.
CO2	Have developed a very good understanding of the various techniques of studying different forms of Fungi and bryophytes,
CO3	Are able to perform basic experiments to understand the morphology, Biochemical, Host

	Pathogen interaction, plant disease development and control and their applications for the welfare of mankind in terms of Food security.
CO4	Are able to apply the concepts of mycology and Bryophytes to better understand the structural organization and Reproduction of microbes.
CO5	Are able to apply the concepts of Plant Anatomy to better understand the structural organization and functions of various tissue systems of plant body.
CO6	Can explore the structure-function relationships of various plant forms in the advancement of the discipline by performing experimental studies.

NOTE: Similar to the above paper, Course outcomes to be written to the other courses of this semester and the rest semesters.