BOARD OF STUDIES

IN

B.Sc BOTANY

2024-2025

DEPARTMENT OF BOTANY

SYLLABUS FOR B.Sc BOTANY Honours
&
B.Sc BOTANY

PITHAPUR RAJAH'S GOVERNMENT COLLEGE

Autonomous and Accredited with 'A' Grade by NAAC (3.17 CGPA)
KAKINADA – 533 001, E G Dist., ANDHRA PRADESH

PITHAPUR RAJAH'S GOVERNMENT COLLEGE (AUTONOMOUS), KAKINADA
I B.Sc.Honours -Botany-Major & Minor / II Semester End
(W.E.F. 2024-25)

Course 3: Non-Vascular Plants (Algae, Fungi, Lichens and Bryophytes)
Credits -4

I. Learning Objectives: By the end of this course the learner has:

1. To realize the characteristics and diversity of non-vascular plants.
2. To recognize the ecological and economic value of algae, fungi, lichens and bryophytes.
3. To inquire the habit, habitat, morphological features and life cycles of selected genera of non-vascular plants.

II. Learning Outcomes: On completion of this course students will be able to:

1. Compile the general characteristics of algae and their significance in nature.
2. Compare and contrast the characteristics of different groups of algae.
3. Summarise the important features of fungi and their economic value.
4. Distinguish the characteristics of different groups of fungi.
5. Elaborate the features and significance of amphibians of plant kingdom
6. Explain the diversity among non-vascular plants.

III. Syllabus of Theory:

Unit-1: Introduction to Algae **8Hrs.**

1. General Characteristics of algae: Occurrence and distribution, cell structure, pigments, flagella and reserve food material.
2. Classification of algae: F.E.Fritsch (1935) and Lee (2008)
3. Thallus organization and life cycles in algae.
4. Ecological and economic importance of algae.

Unit-2: Biology of selected Algae **10Hrs.**

1. Occurrence, structure, reproduction and life cycle of:
   (a) Chlorophyceae: *Spirogyra* (b) Phaeophyceae: *Ectocarpus*
   (c) Xanthophyceae: *Vaucheria* (d) Rhodophyceae:*Polysiphonia*
2. A brief account of Bacillariophyceae
3. Culture and cultivation of *Chlorella*

Unit-3: Introduction to Fungi **8Hrs.**

1. General characteristics of fungi and Ainsworth (1973) classification.

2. Thallus organization and nutrition in fungi.
3. Reproduction in fungi (asexual and sexual); Heterothallism and parasexuality.
4. Ecological and economic importance of fungi.

Unit-4: Biology of selected Fungi **10Hrs.**

1. Occurrence, structure, reproduction and life cycle of:
   (a) Mastigomycotina: *Phytophthora* (b) Zygomycotina: *Rhizopus*
   (c) Ascomycotina: *Penicillium* (d) Basidiomycotina: *Puccinia*
2. Occurrence, structure and reproduction of lichens; ecological and economic importance of lichens.

Unit-5: Biology of Bryophytes **9Hrs.**

1. General characteristics of Bryophytes; Rothmaler (1951) classification.
2. Occurrence, morphology, anatomy, reproduction (developmental details are not needed) and life cycle of
   (a) Hepaticopsida: *Marchantia* (b) Anthoceratopsida: *Anthoceros*
   (c) Bryopsida: *Funaria*
3. General account on evolution of sporophytes in Bryophyta.

IV. Text Books:

1. Pandey, B.P. (2013) College Botany, Volume-I, S. Chand Publishing, New Delhi
2. Hait,G., K.Bhattacharya & A.K.Ghosh (2011) A Text Book of Botany, Volume-I, New Central Book Agency Pvt. Ltd., Kolkata

V. Reference Books:

1. Fritsch, F.E. (1945) The Structure & Reproduction of Algae (Vol. I & Vol. II) Cambridge University Press Cambridge, U.K.
2. Bold, H.C.& M. J. Wynne (1984) Introduction to the Algae, Prentice-Hall Inc., New Jersey
3. Robert Edward Lee (2008) Phycology. Cambridge University Press, New York
4. Van Den Hoek, C., D.G.Mann & H.M.Jahns (1996)Algae : An Introduction to Phycology. Cambridge University Press, New York.
5. Alexopoulos, C.J., C.W.Mims & M.Blackwell (2007) Introductory Mycology, Wiley& Sons, Inc., New York
6. Mehrotra, R.S.& K. R. Aneja (1990) An Introduction to Mycology. New Age

International Publishers, New Delhi.

7. Kevin Kavanagh (2005) Fungi; Biology and Applications John Wiley& Sons, Ltd., West Sussex, England.
8. John Webster & R. W. S. Weber (2007) Introduction to Fungi, Cambridge University Press, New York.
9. Shaw, A.J.& B.Goffinet (2000) Bryophyte Biology .Cambridge University Press, New York.

VI. Suggested activities and evaluation methods:

Unit-1: Activity: Algae specimen collection from any water bodies in their locality, recording the characteristics, identification and classifying them according to Fritsch system.

Evaluation method: Evaluating the presentation or report summarizing findings.

Unit-2: Activity: Microscopic observations and recording distinguishing characters of any six algal forms excluding the genera in the syllabus.

Evaluation method: Conducting a Quiz or an exam/ evaluating the chart or drawings or summarized data on similarities and differences.

Unit-3: Activity: Collection or laboratory culture of fungi and reporting the important features.

Evaluation method: Evaluating the report/conducting JAM/Quiz/Group discussion.

Unit-4: Activity: Microscopic observations and summarizing the salient features of the fungal genera and lichen forms in the syllabus**.**

Evaluation method: Conducting a Quiz or an exam/ evaluating the chart or drawings or concise data on similarities and differences.

Unit-5: Collection, characterization, identification and classification of any four bryophytes from their native locality or college campus.

Evaluation method: Assessment of observations and documentation accuracy/presentation or report summarizing findings based on a rubric.

PITHAPUR RAJAH'S GOVERNMENT COLLEGE (AUTONOMOUS), KAKINADA
I B.Sc.Honours -Botany-Major & Minor / II Semester End
(W.E.F. 2024-25)
Course 3: Non-Vascular Plants (Algae, Fungi, Lichens and Bryophytes)

PRACTICAL SYLLABUS

Credits -1

I. Course Outcomes: On successful completion of this practical course, student shall be able to:

1. Identify some algal and fungal species based on the structure of thalli and reproductive organs.
2. Decipher the lichens and Bryophytes based on morphological, anatomical and reproductive features.

II. Laboratory/field exercises:

Study/ microscopic observation of vegetative, sectional/anatomical and reproductive structures of the following using temporary or permanent slides/ specimens/ mounts:

1. **Algae:** *Spirogyra, Ectocarpus, Vaucheria and Polysiphonia;* a centric and a pennate diatom.
2. Demonstration of culture and cultivation of *Chlorella*
3. Identification of some algal products available in local market.
4. **Fungi:** *Phytophthora, Rhizopus, Penicillium* and *Puccinia*
5. Identification of some fungal products available in the local market.
6. **Lichens:** Crustose, foliose and fruiticose
7. **Bryophyta:** *Marchantia, Anthoceros* and *Funaria.*

PITHAPUR RAJAH'S GOVERNMENT COLLEGE (AUTONOMOUS), KAKINADA
I Year B.Sc. HONURS BOTANY
Major & Minor
Practical Examinations at II Semester End
Model Paper
Course-3: Non-Vascular Plants (Algae, Fungi, Lichens and Bryophytes)
(2024-25)

Time: 2 Hrs. **Max. Marks: 50**

---

1. Identify the givenAlga material l **A.** Make a temporary slide and justify the characters

10m

2. Identify the given Fungal material **B.** Make a temporary slide and justify the characters

10m

3. Identify the given Bryophyta material **C.** Make a temporary slide and justify the characters

10m

4. Identify the given Spotters and justify the characters. **3 X 4 = 12 m**

D- Algae

E-Fungi

F-lichen

5.Record + Viva voce **5+3 = 8m**

PITHAPUR RAJAH'S GOVERNMENT COLLEGE (AUTONOMOUS), KAKINADA
I B.Sc., -Botany/ II Semester End (W.E.F. 2024-25)
Major & Minor
Course 3 :- Non- Vascular Plants (Algae, Fungi, Lichens and Bryophytes)
Mapping as per Blooms Taxonomy

S. NO	Subject	Semester	Title of the course (Paper)	Topic	Parameters as per Blooms Taxonomy (knowledge/ Application / Creativity/ Innovation)	Experiential learning component	Scope (skill/ employability/entrepreneurship)
1	Botany	II	Non–Vascular Plants	Introduction to Algae	knowledge	Shall be shown by Microscope & Photographs	Skill
2	Botany	II	Non–Vascular Plants	Biology of selected Algae	knowledge	Shall be shown by Microscope & Photographs	Skill
3	Botany	II	Non–Vascular Plants	Introduction to Fungi	knowledge	Shall be shown by Microscope & Photographs	Skill
4	Botany	II	Non–Vascular Plants	Biology of Selected Fungi	knowledge	Shall be shown by Microscope & Photographs	Skill
5	Botany	II	Non–Vascular Plants	Biology of Bryophytes	knowledge	Shall be shown by Microscope & Photographs	Skill

CO-PO Mapping

	Pithapur Rajah's Government College (Autonomous) Kakinada	Program & Semester I B.Sc. Honours (II Semester)			
Course3	**TITLE OF THE COURSE Non-Vascular Plants(Algae, Fungi, Lichens & Bryophytes)**				
Teaching	Hours Allocated: 60 (**Theory**)	L	T	P	C
Pre-requisites:		3	1	2	3

Course Objectives

1. To realize the characteristics and diversity of non-vascular plants.
2. To recognize the ecological and economic value of algae, fungi, lichens and bryophytes.
3. To inquire the habit, habitat, morphological features and life cycles of selected genera ofnon-vascular plants.

Course Outcomes

On Completion of the course, the students will be able to-	
CO1	Compile the general characteristics of algae and their significance in nature.
CO2	Compare and contrast the characteristics of different groups of algae.
CO3	Summarise the important features of fungi and their economic value.
CO4	Distinguish the characteristics of different groups of fungi.
CO5	Elaborate the features and significance of amphibians of plant kingdom

CO-PO Mapping:

(1:Slight[Low]; 2:Moderate[Medium]; 3:Substantial[High], '-':No Correlation)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	2	2	2	2	3	3	2	3	3	3
CO2	2	2	2	3	3	3	3	3	3	3
CO3	1	1	2	1	3	3	3	3	3	3
CO4	1	1	2	1	3	3	3	3	3	3
CO5	2	2	2	2	3	3	3	3	3	3

PITHAPUR RAJAH'S GOVERNMENT COLLEGE (AUTONOMOUS), KAKINADA
I B.Sc.Honours -Botany-Major / II Semester End (W.E.F. 2024-25)

Course 4: Origin of Life and Diversity of Microbes

Credits -3

I. Learning Objectives: By the end of this course the learner has:

1. To get awareness on origin and evolution of life.
2. To understand the diversity of microbial organisms.
3. To get awareness on importance of microbes in nature and agriculture.

II. Learning Outcomes: On completion of this course students will be able to:

1. Illustrate diversity of viruses, multiplication and economic value.
2. Discuss the general characteristics, classification and economic importance of special groups of bacteria.
3. Explain the structure, nutrition, reproduction and significance of eubacteria.
4. Evaluate the interactions among soil microbes.
5. Compile the value and applications of microbes in agriculture.

III. Syllabus of Theory:

Unit-1: Origin of life and Viruses **10 Hrs.**

1. Origin of life, concept of primary Abiogenesis; Miller and Urey experiment.; discovery of microorganisms, Pasteur experiments, germ theory of diseases.
2. Five kingdom classification of R.H. Whittaker
3. Shape and symmetry of viruses; structure of TMV and Gemini virus.
4. Multiplication of TMV; A brief account of prions, viroids and virusoids; Transmission of plant viruses and their control.
5. Significance of viruses in vaccine production, bio-pesticides and as cloning vectors.

Unit-2: Special groups of Bacteria **7 Hrs.**

1. General characteristics, outline classification and economic importance of following special groups of bacteria:

   a) Archaebacteria b) Chlamydiae c) Actinomycetes

   d) Mycoplasma e) Phytoplasma f) Cyanobacteria

2. Culture and cultivation of *Spirulina*

Unit-3: Eubacteria **8 Hrs.**

1. Occurrence, distribution and cell structure of eubacteria.
2. Classification of Eubacteria based on nutrition.
3. Reproduction- Asexual (Binary fission and endospores) and bacterial recombination (Conjugation, Transformation, Transduction).
4. Economic importance of Eu-bacteria with reference to their role in Agriculture and industry (fermentation and medicine).

Unit-4: Soil microbes – interactions **10Hrs.**

1. Distribution of soil microorganisms in soil.
2. Factors influencing the soil microflora - Role of microorganisms in soil fertility.
3. Interactions among microorganisms, mutualism, comensalism, competition, amensalism, parasitism, predation.
4. Microorganisms of rhizosphere, phyllosphere and spermophere; microbial interactions and their effect on plant growth.

Unit-5: Microbes in agriculture **10 Hrs.**

1. Mass production, mode of applications, advantages and limitations of bacterial inoculants (*Rhizobium, Azotobacter, Azospirillum*, Cyanobacteria).
2. Role of Frankia and VAM in soil fertility.
3. Microbial biopesticides: mode of action, factors influencing, target pests; microbial herbicides.

IV. Text Books:

1. Bhattacharjee, R.N., (2017) Introduction to Microbiology and Microbial Diversity, Kalyani Publishers, New Delhi.
2. Dubey, R.C. & D. K. Maheswari (2013) A Text Book of Microbiology, S.Chand & Company Ltd., New Delhi
3. Toshniwal, R.L. (2007) Agricultural Microbiology, Agrobios (India), Jodhpur

V. Reference Books:

1. Pelczar Jr., M.J., E.C.N. Chan & N. R. Krieg (2001) Microbiology, Tata McGraw- Hill Co, New Delhi
2. Presscott, L. Harley, J. and Klein, D. (2005) Microbiology, Tata McGraw –Hill Co. New Delhi.

3. Gyaneshwar, A.D., G.J. Parekh, and V.S. Reddy (2004) Agricultural Microbiology: Plant-Soil Interactions, Research Signpost, Kerala, India
4. Zaki A. Shuler and Zainul Abid (2014) Agricultural Microbiology: Principles and Applications, CRC Press, Boca Raton, Florida, USA

VI. Suggested activities and evaluation methods:

Unit-1: Activity: Collecting scientific literature on historical developments in microbiology.

Evaluation method: Evaluating the report based on a rubric.

Unit-2: Activity: Group discussion on various groups of special bacteria.

Evaluation method: Assessment of active participation, soft skills, communication skills, collaborative skills, time management etc., of a group or a student based on a rubric.

Unit-3: Activity: Presentation or poster summarizing the classification of Eu-bacteria based on nutrition.

Evaluation method: Assessment based on accuracy and understanding.

Unit-4: Activity: Microscopic observation of bacterial samples from soil/ phylloplane in their native place/ college campus.

Evaluation method: Evaluating the report on characteristics and classification of eubacteria.

Unit-5: Activity: Culture and mass production of bioinoculants.

Evaluation method: Skills performed in establishing the culture and mass production.

PITHAPUR RAJAH'S GOVERNMENT COLLEGE (AUTONOMOUS), KAKINADA
I B.Sc.Honours -Botany-Major / II Semester End (W.E.F. 2024-25)

Course 4: Origin of Life and Diversity of Microbes

PRACTICAL SYLLABUS

Credits -1

I. Course Outcomes: On successful completion of this practical course, student shall be able to:

1. Take all necessary precautions in the microbiology laboratory.
2. Handle the instruments and prepare media for laboratory work.
3. Identify various microbes through microscopic observations

II. Laboratory/Field exercises:

1. Microbiology good laboratory practices and biosafety.
2. Study the principle and applications of important instruments (autoclave, hot air oven, incubator, Inoculation loop, Inoculation needle, membrane filter, laminar air flow system, colony counter. biological safety cabinets, BOD incubator, pH meter) used in the microbiology laboratory.
3. Study of Viruses (Gemini and TMV) using electron micrographs/ models.
4. Gram staining technique of Bacteria.
5. Microscopic study of Cyanobacteria using temporary/permanent slides.
6. Microscopic study of Eubacteria using temporary/permanent slides.
7. Study of Archaebacteria and Actinomycetes using permanent slides/ electron micrographs/diagrams.

PITHAPUR RAJAH'S GOVERNMENT COLLEGE (AUTONOMOUS), KAKINADA
I Year B.Sc. HONOURS BOTANY
Practical Examinations at II Semester End
Model Paper

Course 4: Origin of Life and Diversity of Microbes

(2024-25)

Time: 2 Hrs. **Max. Marks: 50**

1.Demonstrate the gram staining technique in bacteria **10m**

2.Identify the given material A (Cyanobacteria) and draw the diagram, justify the characters **10m**

3. Identify the given material B (Eubacteria) and draw the diagram, justify the characters **10m**

4. Identify the given Spotters and justify the characters **3 X 4 = 12m**

C-Laboratory equipment

D-virus (Gemini/TMV)

E-special type of bacteria (Archaebacteria / Actinomycetes)

5.Record + Viva Voce **5 + 3 = 8m**

PITHAPUR RAJAH'S GOVERNMENT COLLEGE (AUTONOMOUS), KAKINADA
I B.Sc.Honours -Botany-Major / II Semester End (W.E.F. 2024-25)

Course 4: Origin of Life and Diversity of Microbes

Mapping as per Blooms Taxonomy

S. NO	Subject	Semester	Title of the course (Paper)	Topic	Parameters as per Blooms Taxonomy (knowledge/ Application / Creativity/ Innovation)	Experiential learning component	Scope (skill/ employability /entrepreneurship)
1	Botany	II	Origin of Life and Diversity of Microbes	Origin of life and Viruses	Knowledge & Application	Lecture, case study, projects	Skill, Employability
2	Botany	II	Origin of Life and Diversity of Microbes	Special groups of Bacteria	Knowledge & Application	Lecture, by showing photographs	Skill, Employability
3	Botany	II	Origin of Life and Diversity of Microbes	Eubacteria	Knowledge & Application	Lecture, by showing photographs	Skill, Employability
4	Botany	II	Origin of Life and Diversity of Microbes	Soil microbes – interactions	Knowledge & Application	Lecture, case study, projects	Skill, Employability
5	Botany	II	Origin of Life and Diversity of Microbes	Microbes in agriculture	Knowledge, Application & Innovation	Lecture, case study, projects	Skill, Employability

CO-PO Mapping

	Pithapur Rajah's Government College (Autonomous) Kakinada	Program & Semester I B.Sc. Honours (IISemester)			
Course4	**TITLE OF THE COURSE Origin of Life and Diversity of Microbes**				
Teaching	Hours Allocated: 60 (**Theory**)	L	T	P	C
Pre-requisites:		3	1	2	3

Course Objectives

1. To get awareness on origin and evolution of life.
2. To understand the diversity of microbial organisms.
3. To get awareness on importance of microbes in nature and agriculture.

Course Outcomes

On Completion of the course, the students will be able to-	
CO1	Illustrate diversity of viruses, multiplication and economic value.
CO2	Discuss the general characteristics, classification and economic importance of special groups of bacteria
CO3	Explain the structure, nutrition, reproduction and significance of eubacteria.
CO4	Evaluate the interactions among soil microbes.
CO5	Compile the value and applications of microbes in agriculture.

CO-PO Mapping:

(1:Slight[Low]; 2:Moderate[Medium]; 3:Substantial[High], '-':No Correlation)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	2	2	2	2	3	3	3	3	3	3
CO2	2	3	2	3	3	3	3	3	3	3
CO3	2	3	2	3	3	3	2	3	3	3
CO4	2	2	3	2	3	3	3	3	3	3
CO5	3	2	3	2	3	3	3	3	3	3