

ST JOSEPH'S UNIVERSITY

BENGALURU-27



BOTANY

SYLLABUS

**FOR UNDERGRADUATE PROGRAMME
BEZ (BOTANY, ENVIRONMENTAL SCIENCE AND
ZOOLOGY)**

(AS PER SEP 2026-29)

Semester	I (BEZ)
Paper Code	BO 1326
Paper Title	Diversity of life forms I
Number of teaching hours per week	03
Total number of teaching hours of theory per semester	45
Number of theory credits	03
Total number of teaching hours of practical per semester	33
Number of practical credits	02

<p>COURSE OBJECTIVES (CO)</p>	<p>CO1: Recall the fundamental concepts, historical development, scope, and classification of microorganisms, algae, and fungi, including their general characteristics and diversity.</p> <p>CO2: Explain the structural organization, cell types, and reproductive strategies of bacteria, viruses, algae, and fungi using representative examples.</p> <p>CO3: Describe life cycles and modes of reproduction in microbes, algae, and fungi, including genetic recombination in bacteria and different life cycle patterns in algae and fungi.</p> <p>CO4: Analyze similarities and differences among prokaryotic and eukaryotic organisms, and among major algal and fungal groups, based on structural, reproductive, and functional features.</p> <p>CO5: Evaluate the ecological roles and environmental significance of microorganisms, algae, and fungi in nutrient cycling, climate regulation, symbiosis, and ecosystem sustainability.</p> <p>CO6: Integrate biological knowledge to assess applied and emerging aspects such as microbial remediation, antibiotic resistance, algal biofuels, and industrial and agricultural applications of fungi.</p>
<p>LEARNING OUTCOMES (LO)</p>	<p>After completion of the course -</p> <p>LO1: Students will be able to recall and define fundamental concepts, terminology, classification systems, and diversity of microorganisms, algae, and fungi.</p> <p>LO2: Students will be able to describe the structural organization, cell types, and modes of reproduction in bacteria, viruses, algae, and fungi with suitable examples.</p> <p>LO3: Students will be able to explain life cycles and reproductive strategies, including bacterial genetic recombination, viral replication cycles, and algal and fungal life cycle patterns.</p>

LO4: Students will be able to analyze similarities and differences among prokaryotic and eukaryotic organisms, and among major algal and fungal groups, based on structural and reproductive features.

LO5: Students will be able to assess the ecological roles and environmental significance of microorganisms, algae, and fungi in nutrient cycling, symbiosis, climate regulation, and ecosystem functioning.

LO6: Students will be able to apply biological knowledge to evaluate applied and emerging areas such as antibiotic resistance, microbial remediation, algal biofuels, and industrial and agricultural uses of fungi.

BO 1326: Diversity of Life Forms-I

	MICROBIOLOGY AND MICROBIAL DIVERSITY	15 hours
Unit I	Introduction to Microbiology Definition, history, scope and branches of microbiology. General account of Bacteria, Archaea, Viruses and Fungi. Comparative account of prokaryotic and eukaryotic cell types.	2
Unit II	Bacteria Ultrastructure of Gram positive and Gram negative cell walls. Reproduction - Binary fission. Genetic recombination – transformation, transduction and conjugation.	6
Unit III	Virus General characteristics. Culturing of viruses. Life cycle of bacteriophage -lytic and lysogenic cycle.	4
Unit IV	Applications and emerging areas <i>A brief account of bacterial endophytes and their significance.</i> A brief account on antibiotics, antibiotic resistance and public health implications. Role of methanogenic bacteria in climate change. <u>Microbial remediation.</u> <u>Economic importance of viruses.</u>	1+2
	ALGAE	15 hours
Unit V	Algae - general concepts Definition, habitat diversity. General account of thallus organization and reproduction. <i>A brief account of algal pigments, reserve food materials and cell wall composition. Outline of classification of algae by Fritsch.</i>	4+1
Unit VI	Algae – Type study Structure and reproduction of the following forms– <i>Anabaena, Volvox (evolution of multicellularity), Chara, Sargassum and Batrachospermum.</i> Life cycle types - Haplontic, diplontic, haplodiplontic life cycles and triphasic life cycles.	8
Unit VII	Applications of algae <u>Algal blooms and eutrophication.</u> <u>Useful algal products in medicine, food, industry.</u> Algal biofuels- production of biodiesel – isolation, strain selection, culture methods, extraction and product purification and characterisation	1+1
	FUNGI	15 hours
Unit VIII	Introduction to fungi General characteristics, Overview of thallus organization and modes of reproduction – vegetative, asexual and sexual reproduction. Outline of classification according to G C Ainsworth (1973). <u>Fungal symbiotic relations:</u> <u>Mycorrhizae- types and significance. Lichens – types and ecological role. Fungal endophytes and their applications.</u>	3+2
Unit IX	Fungi – Type study Detailed study of morphology and reproduction of <i>Pythium, Rhizopus, Peziza, Puccinia.</i> General account of class	6

	Deuteromycetes.	
Unit X	Applied aspects Role of fungi in industry (antibiotics, enzymes, fermentation). Significance of fungi in sustainable agriculture, soil carbon storage and environmental cycling. Brief account of harmful effects of fungi.	4

NOTE: Portions that are underlined are meant for self-study

BO 1P3 26: DIVERSITY OF LIFE FORMS I (BEZ)	
Total: 33 Hours (11 Sessions and 3 hours per week)	
LIST OF EXPERIMENTS	
Practical 1	Laboratory organization and instrumentation
Practical 2	Preparation of culture media – Potato Dextrose Agar and Nutrient Agar
Practical 3	Serial dilution and inoculation (pour plate and streaking)
Practical 4	Gram staining of isolated bacterial cultures
Practical 5	Type study of representative members of Cyanophyceae – <i>Anabaena</i> and Chlorophyceae – <i>Volvox</i> , <i>Spirogyra</i>
Practical 6	Type study of representative members of Xanthophyceae – <i>Vaucheria</i> , Phaeophyceae - <i>Sargassum</i> and Rhodophyceae - <i>Batrachospermum</i>
Practical 7	Identification of algae from water samples (atleast upto thallus organization level)
Practical 8	Extraction and separation algal pigments using paper chromatography
Practical 9	Type study of representative members of Myxomycotina - <i>Stemonitis</i> , Mastigmycotina – <i>Saprolegnia</i> and Zygomycotina - <i>Rhizopus</i>
Practical 10	Type study of representative members of Ascomycotina - <i>Peziza</i> , Basidiomycotina – <i>Puccinia</i> and Deuteromycotina - <i>Cercospora</i>
Practical 11	Revision/Makeup lab/Attestation of records.

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ST JOSEPH'S UNIVERSITY, BENGALURU - 560027
SCHOOL OF LIFE SCIENCES, DEPARTMENT OF BOTANY
I B.Sc. I SEMESTER (BEZ)
BO 1P3 26 – DIVERSITY OF LIFE FORMS I
BOTANY PRACTICAL EXAMINATION

MAX. MARKS: 25

TIME: 3 HOURS

1. Perform gram staining for the given sample A. Write principle, observations and result 5
2. Identify specimens B and C with classification and reasons $2 \times 3 = 6$
3. Identify the slides D and E with labelled diagrams and reasons $2 \times 3 = 6$
4. Comment on spotters F and G $2 \times 2 = 4$
5. Separate the photosynthetic pigments from sample H. Calculate Rf values. 4

KEY

A: Bacterial culture/ Curd sample etc

B, C: Algae and Fungi specimen

D, E: Algae and Fungi permanent slides

F, G: Microbial instruments, culture plates, serial dilution etc

H: Algal photosynthetic extract

THEORY QUESTION PAPER PATTERN

ST JOSEPH'S UNIVERSITY, BENGALURU - 560027

B.Sc. BOTANY – I SEMESTER, BEZ

SEMESTER EXAMINATION

BO 1326: DIVERSITY OF LIFE FORMS I

(Only for current BEZ students)

Time: 2 Hours

Max Marks: 60

The paper contains TWO printed pages and THREE parts

Draw diagrams and provide examples wherever necessary

D. Answer ANY TEN of the following $10 \times 2 = 20$

- 22.
- 23.
- 24.
- 25.
- 26.
- 27.
- 28.
- 29.
- 30.
- 31.
- 32.
- 33.

E. Answer any ANY FIVE of the following

$5 \times 6 = 30$

- 34.
- 35.
- 36.
- 37.
- 38.
- 39.
- 40.

F. Answer any ONE of the following

$1 \times 10 = 10$

- 41.
- 42.

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Unit number	Number of hrs.	Total marks for which the questions are to be asked (including bonus questions)
I	2	4
II	4	8
III	6	10
IV	3	6
V	5	10
VI	8	16
VII	2	4
VIII	5	10
IX	6	10
X	4	8
TOTAL	45	86
Note: Maximum marks for the paper (Excluding bonus question): 60		

Semester	II (BEZ)
Paper Code	BO 2326
Paper Title	Diversity of life forms- II
Number of teaching hours per week	03
Total number of teaching hours of theory per semester	45
Number of theory credits	03
Total number of teaching hours of practical per semester	33
Number of practical credits	02

<p>COURSE OBJECTIVES (CO)</p>	<p>CO1: Recall the general characteristics, classification systems, life cycles, and distribution patterns of Bryophytes, Pteridophytes, and Gymnosperms.</p> <p>CO2: Explain the morphology, anatomy, and reproductive features of representative plant groups such as <i>Marchantia</i>, <i>Anthoceros</i>, <i>Sphagnum</i>, <i>Psilotum</i>, <i>Lycopodium</i>, <i>Selaginella</i>, <i>Equisetum</i>, <i>Marsilea</i>, <i>Pinus</i>, and <i>Gnetum</i>.</p> <p>CO3: Apply the knowledge of alternation of generations, heterospory, stelar evolution, and seed habit to understand evolutionary trends in plant groups.</p> <p>CO4: Analyze the affinities and differences among Bryophytes, Pteridophytes, Gymnosperms, and Angiosperms with respect to structural organization and reproductive strategies.</p> <p>CO5: Evaluate the ecological roles of Bryophytes, Pteridophytes, and Gymnosperms in ecosystem functioning, carbon sequestration, ecological succession, and climate regulation.</p> <p>CO6: Integrate botanical knowledge to assess conservation challenges, climate change impacts, and the significance of bioactive compounds and dendrochronological studies in environmental monitoring.</p>
<p>LEARNING OUTCOMES (LO)</p>	<p>After completion of the course -</p> <p>LO1: Students will be able to identify and recall fundamental botanical terms, concepts, classifications, and examples related to plant diversity, structure, reproduction, and evolution.</p> <p>LO2: Students will be able to describe and explain the morphology, anatomy, life cycles, and reproductive strategies of major plant groups, including lower and higher plants.</p> <p>LO3: Students will be able to apply botanical principles to interpret plant structures, life cycles, alternation of generations, ecological roles, and evolutionary adaptations.</p> <p>LO4: Students will be able to analyze similarities, differences, and evolutionary relationships among plant groups using structural,</p>

	<p>reproductive, and ecological criteria.</p> <p>LO5: Students will be able to assess the ecological, economic, and environmental significance of plants, including their roles in ecosystem stability, climate regulation, and sustainable use.</p> <p>LO6: Students will be able to integrate botanical knowledge to formulate explanations, solve biological problems, interpret data (e.g., ecological or dendrochronological data), and propose conservation or environmental strategies.</p>
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BO 2326: Diversity of Life Forms-II

Unit No.	BRYOPHYTES	15 hours
UNIT I	<p>Bryophytes - General concepts Bryophytes: Distribution, general characters, alternation of generations, and classification of Bryophytes by Proskauer (1957).</p>	3
UNIT II	<p>Bryophytes - Type study Morphology, anatomy, and reproduction of <i>Marchantia</i>, <i>Anthoceros</i>, and <i>Sphagnum</i> (developmental details not required)</p>	6
UNIT III	<p>Ecological Implications of Bryophytes Bryophytes for microhabitat creation (algae, fungi, higher plants insects and microorganisms) Bryophytes as ecological indicators, ecological succession, peat formation, carbon sequestration. <i>Economic importance of Bryophytes (self-study)</i></p>	4+<u>2</u>
	PTERIDOPHYTES	15 hours
UNIT IV	<p>General account of pteridophytes - General characteristics and classification (Smith, 1955). <i>Affinities of pteridophytes with bryophytes and gymnosperms (Self study)</i></p>	2 + <u>1</u>
UNIT V	<p>Sporophyte structure, anatomy, and reproduction of <i>Psilotum</i>, <i>Selaginella</i>, <i>Equisetum</i>, and <i>Marsilea</i>. Heterospory and seed habit. Stelar evolution in Pteridophytes</p>	9
UNIT VI	<p>Pteridophytes in ecology and conservation - ecological succession, ecological indicators and microclimate regulation. Economic importance of pteridophytes - paleobotanical (coal formation), ornamental, and medicinal uses. <i>Bioactive compounds derived from pteridophytes.</i></p>	2 + <u>1</u>
	GYMNOSPERMS	15 hours
UNIT VII	<p>General Account of Gymnosperms: General characteristics and classification (Yang et al., 2022); Global and Indian distribution; <i>Ecological significance in forest ecosystems;</i> Affinities of gymnosperms with angiosperms.</p>	2 + <u>1</u>

UNIT VIII	Study of Representative Gymnosperms: <i>Pinus</i> - Systematic position; Morphology and internal anatomy; Reproductive structures and life cycle; Adaptations to temperate and xeric environments. <i>Gnetum</i> - Systematic position; Morphology and internal anatomy; Reproductive structures and life cycle; Angiosperm-like features; Ecological significance. Brief account of fossil gymnosperms	6
UNIT IX	Gymnosperms and Climate Change: <u>Role of gymnosperms in carbon sequestration</u> ; Sensitivity to temperature and rainfall changes; Treeline shifts and forest dynamics; Conservation challenges under climate change. Dendrochronology and its applications. Bioactive Compounds: Secondary metabolites in Gymnosperms.	5+1

NOTE: Portions that are underlined are meant for self-study

BO 2P3 26: DIVERSITY OF LIFE FORMS II (BEZ)	
Total: 33 Hours (11 Sessions and 3 hours per week)	
LIST OF EXPERIMENTS	
Practical 1	Type study of <i>Marchantia</i> and morphology of <i>Anthoceros</i>
Practical 2	Reproduction of <i>Anthoceros</i> and type study of <i>Sphagnum</i>
Practical 3	Stelar variations and reproductive structures of <i>Psilotum</i> , <i>Lycopodium</i> and <i>Selaginella</i>
Practical 4	Study of morphology, anatomy, and reproductive structures and <i>Equisetum</i>
Practical 5	Study of morphology, anatomy, and reproductive structures of <i>Marsilea</i> .
Practical 6	Study of morphology and anatomy in <i>Pinus</i> . Temporary slide preparation of <i>Pinus</i> needle.
Practical 7	Study of reproduction in <i>Pinus</i>
Practical 8	Study of morphology, anatomy and reproduction of <i>Gnetum</i> .
Practical 9	Economic importance of Gymnosperms with special reference to medicine.
Practical 10	Industrial/field visit
Practical 11	Revision/Makeup lab/Attestation of records.

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BLUEPRINT OF THEORY EXAM QUESTION PAPER

Unit No.	Number of hrs.	Total marks for which the questions are to be asked (including bonus questions)
I	3	6
II	6	11
III	6	11
IV	3	6
V	9	18
VI	3	6
VII	3	6
VIII	6	11
IX		11
TOTAL	45	86
Note: Maximum marks for the paper (Excluding bonus question): 60		

ST JOSEPH'S UNIVERSITY, BENGALURU - 560027
SCHOOL OF LIFE SCIENCES, DEPARTMENT OF BOTANY
I B.Sc. II SEMESTER (BEZ)
BO2P326 – DIVERSITY OF LIFE FORMS II
BOTANY PRACTICAL EXAMINATION

MAX. MARKS: 25

TIME: 3 HOURS

1. Identify specimens A, B and C with classification and reasons **3 × 3 = 9**
2. Prepare a temporary slide of D, identify, comment and leave the preparation for evaluation **4**
3. Identify the slides E, F and G with labelled diagrams and reasons **4 × 3 = 12**

KEY

A, B, C: Bryophytes, Pteridophytes and Gymnosperms specimens

D: *Equisetum* stem, *Pinus* needle

E, F, G: Bryophytes, Pteridophytes and Gymnosperms permanent slides
THEORY QUESTION PAPER PATTERN

ST JOSEPH'S UNIVERSITY, BENGALURU - 560027

B.Sc. BOTANY – II SEMESTER, BEZ

SEMESTER EXAMINATION

BO 2326: DIVERSITY OF LIFE FORMS II

(Only for current BEZ students)

Time: 2 Hours

Max Marks: 60

The paper contains TWO printed pages and THREE parts

Draw diagrams and provide examples wherever necessary

A. Answer ANY TEN of the following in 2 or 3 sentences

10 × 2 = 20

- 1.
- 2.
- 3.
- 4.
- 5.
- 6.
- 7.
- 8.
- 9.
- 10.
- 11.
- 12.

B. Write critical notes on ANY FIVE of the following

5 × 6 = 30

- 1.
- 2.
- 3.
- 4.
- 17
- 18.
- 19.

C. Give a comprehensive account on ANY ONE of the following

1 × 10 = 10

- 20
- 21