



# **Tripura University**

**(A Central University)**

**Suryamaninagar**

**West Tripura**

**Syllabus for**

**Four Years Undergraduate Programme**

**Subject: Botany (Major)**

**(As per NEP-2020)**

**Year - 2023**



**Tripura University**  
(A Central University)

**Course Structure of Botany (UG Programme)**  
**As per NEP-2020 under Tripura University**

**BOTANY MAJOR**

Year	Semester	Paper	Credits	Mark	Unit - I	Unit - II	Unit-III	Unit-IV
1 <sup>st</sup>	1 <sup>st</sup> BT101C	Paper-1 Theory	4	100 (IA=40 + ESE=60)	Microbiology-I	Microbiology-II	Phycology-I	Phycology-II
		Paper-2A Theory	2	60 (IA=24 + ESE=36)	Mycology-I	Mycology-II	Mycology-III	Lichen, Myxomycetes & Mycorrhiza
	Paper-2B Practical		2	40 (IA=16 + ESE=24)	<i>Based on Theory paper 1 &amp; 2A</i>			
	2 <sup>nd</sup> BT103C	Paper-3 Theory	4	100 (IA=40 + ESE=60)	Bryophyta	Pteridophyta	Gymnosperms	Basic Paleobotanical Principles
	2 <sup>nd</sup> BT104C	Paper-4A Theory	2	60 (IA=24 + ESE=36)	Fossil Plants-I	Fossil Plants-II	Principles of Organic Evolution-I	Principles of Organic Evolution-II
		Paper-4B Practicals	2	40 (IA=16 + ESE=24)	<i>Based on Theory paper 3 &amp; 4A</i>			
2 <sup>nd</sup>	3 <sup>rd</sup> BT201C	Paper-5 Theory	4	100 (IA=40 + ESE=60)	Elementary Phytopathology	Angiosperm Morphology	Plant anatomy	Embryology
		Paper-6A Theory	2	60 (IA=24 + ESE=36)	Taxonomy-I	Taxonomy-II	Monocot Families	Dicot Families
	Paper 6B Practicals		2	40 (IA=16 + ESE=24)	<i>Based on theory paper 5 &amp; 6A</i>			
	4 <sup>th</sup> BT203C	Paper-7 Theory	4	100 (IA=40 + ESE=60)	Plant Ecology-I	Plant Ecology- II	Natural Resource Management & Sustainable Development	Phyto- geography
	4 <sup>th</sup> BT204C	Paper-8A Theory	2	60 (IA=24 + ESE=36)	Biophysics	Biochemistry-I	Biochemistry-II	Biochemistry- III
		Paper 8B Practicals	2	40 (IA=16 + ESE=24)	<i>Based on theory paper 7 &amp; 8A</i>			
3 <sup>rd</sup>	5 <sup>th</sup> BT-301C	Paper-9 Theory	4	100 (IA=40 + ESE=60)	Cell biology-I	Cell Biology-II	Plant Physiology-I	Plant Physiology-II
		Paper-10A Theory	2	60 (IA=24 + ESE=36)	Genetics-I	Genetics-II	Genetics-III	Genetics-IV
	Paper 10B Practicals		2	40 (IA=16 + ESE=24)	<i>Based on theory paper 9 &amp; 10A</i>			
	5 <sup>th</sup> BT303C	Paper-11 Theory	4	100 (IA=40 + ESE=60)	Molecular Biology-I	Molecular Biology-II	Molecular Biology-III	Plant Biotechnology- I
	5 <sup>th</sup> BT304C	Paper-12A Theory	2	60 (IA=24 + ESE=36)	Plant Biotechnology-II	Plant Biotechnology- III	Economic Botany-I	Economic Botany-II
		Paper 12B	2	40	<i>Based on theory paper 11 &amp; 12A</i>			

		Practicals		(IA=16 + ESE=24)				
	<b>6<sup>th</sup> BT305C</b>	Paper-13 Theory	4	100 (IA=40 + ESE=60)	Plant Breeding	Biometry	Horticultural Practices-I	Horticultural Practices-II
	<b>6<sup>th</sup> BT306C</b>	Paper-14A Theory	2	60 (IA=24 + ESE=36)	Floriculture & Gardening-I	Floriculture & Gardening-II	Pharmacognosy	Ethnobotany
		Paper 14B Practical	2	40 (IA=16 + ESE=24)	<i>Based on theory papers 13 &amp; 14A</i>			
	<b>6<sup>th</sup> BT307C</b>	Paper-15 Theory	4	100 (IA=40 + ESE=60)	Industrial and Applied Microbiology-I	Industrial and Applied Microbiology-II	Algal Biotechnology	Applied Mycology
	<b>6<sup>th</sup> BT308C</b>	Paper-16A Theory	2	60 (IA=24 + ESE=36)	Palynology	Biodiversity and its Conservation-I	Biodiversity and its Conservation-II	Biodiversity and its Conservation-III
		Paper 16B Practical	2	40 (IA=16 + ESE=24)	<i>Based on theory papers 15 &amp; 16A</i>			
<b>4<sup>th</sup></b>	<b>7<sup>th</sup> BT401C</b>	Paper-17 Theory	4	100 (IA=40 + ESE=60)	*	*	*	*
	<b>7<sup>th</sup> BT402C</b>	Paper-18A Theory	2	60 (IA=24 + ESE=36)	*	*		
		Paper 18B Practical	2	40 (IA=16 + ESE=24)	<i>Based on theory papers 17 &amp; 18A</i>			
	<b>7<sup>th</sup> BT403C</b>	Paper-19 Theory	4	100 (IA=40 + ESE=60)	*	*	*	*
	<b>7<sup>th</sup> BT404C</b>	Paper-20A Theory	2	60 (IA=24 + ESE=36)	*	*		
		Paper-20B Practical	2	40 (IA=16 + ESE=24)	<i>Based on theory papers 19 &amp; 20A</i>			
	<b>8<sup>th</sup> BT405C</b>	Paper-21 Theory	4	100 (IA=40 + ESE=60)	*	*	*	*
	<b>8<sup>th</sup> BT406C</b>	Paper-22A Theory	2	60 (IA=24 + ESE=36)	*	*		
		Paper-22B Practical	2	40 (IA=16 + ESE=24)	<i>Based on theory papers 21 &amp; 22A</i>			
	<b>8<sup>th</sup> BT407C</b>	Paper-23 Theory	4	100 (IA=40 + ESE=60)	*	*	*	*
	<b>8<sup>th</sup> BT408C</b>	Paper-24A Theory	2	60 (IA=24 + ESE=36)	*	*		
		Paper-24B Practical	2	40 (IA=16 + ESE=24)	<i>Based on theory papers 23 &amp; 24A</i>			

**\*Has been added after 3<sup>rd</sup> year (6<sup>th</sup> semester)**

**DETAILED COURSE CONTENT OF  
BOTANY MAJOR**

**1<sup>st</sup> YEAR**

**Botany (Major)**

**SEMESTER-I**

**Paper- 1 (Theory)**

**BT-101C- Microbiology & Phycology**

**Total Marks = 100 (IA = 40 + ESE = 60)**

**(Credits = 04)**

**Unit-I: Microbiology-I**

1. Significant contributions of Indian Plant Virologist: Pothur Sreenivasulu.
2. Carl Richard Woese's three domain system of classification.
3. **Microbial nutrition & Growth-** Nutritional requirements and nutritional types, Uptake of nutrients by microbial cells, Types of culture medium, Isolation of microbes in pure culture; **Microbial growth-** Phases of microbial growth, Measurement of microbial growth.
4. **Virus:** Nature of virus particles, Definition of Virion, Viroid, Prion & Satellite viruses; General structure of Virus particles - Forms of viral capsids (Helical & icosahedral), Types of nucleic acid in virus with examples, Structure of DNA virus (T4 phage), Lytic and lysogenic cycle, Structure and multiplication of RNA virus (TMV).
5. Transmission and translocation of Plant virus.
6. **Mycoplasma** – Definition & structure, Mycoplasmal plant diseases (examples).
7. **Actinomycetes** – Definition, general characters & Economic importance.

**Unit-II: Microbiology-II**

1. Significant contributions of Indian Plant Bacteriologist: P. Gunasekaran.
2. **Bacteria:** Morphological forms, Structure of bacterial cell.
3. **Bacterial chemotaxis** (definition & mechanism).
4. **Bacterial reproduction:** Asexual - Binary fission, Conidia, Budding, Cysts and Endospore (structure & formation).
5. Bacterial Plasmids (types) & Episome.
6. **Genetic recombination in bacteria** - Transformation, Transduction (Generalized & Specialized) and Conjugation (F-factor,  $F^+ \times F^-$ , Hfr  $\times F^-$ ).
7. **Bacterial nutritional types** – Photosynthetic bacteria (definition and examples of Green sulphur bacteria, purple sulphur bacteria & non-sulphur bacteria); Chemosynthetic bacteria (definition and examples of Sulphur bacteria, Iron bacteria, Hydrogen bacteria & Nitrifying bacteria); Heterotrophic bacteria (Saprophytic & Parasitic).
8. **Economic importance of bacteria:** Beneficial role (role in Agriculture, Industry, Biological Control & Waste Water treatment) & Harmful effects (Food spoilage, Water pollution, Reduction of soil fertility & as Disease causing agent).

### **Unit-III: Phycology-I**

1. Significant contributions of Indian Phycologists: Prof. M. O. P. Iyengar.
2. General characters of Algae: Occurrence, Range of thallus organization, Pigment types, Reserve food materials (RFM) in different groups, Algal Reproduction - Methods of Vegetative, Asexual and Sexual reproduction; Life cycle types.
3. Outline classification of Algae ((Lee, 1999) up to Class.
4. General characters of following algal classes – Cyanophyceae, Chlorophyceae, Xanthophyceae, Bacillariophyceae, Phaeophyceae & Rhodophyceae.
5. Economic importance of Algae.

### **Unit-IV: Phycology-II**

1. Structure, reproduction and life-cycle of the following algal genera:
  - i. *Nostoc*
  - ii. *Oedogonium*
  - iii. *Chara*
  - iv. *Vaucheria*
  - v. *Ectocarpus*
  - vi. *Polysiphonia*
2. Diatoms – Cell structure, reproduction & economic importance.

## Botany (Major)

### SEMESTER-I

#### Paper- 2A (Theory)

#### BT-102C- Mycology, Lichen, Myxomycetes & Mycorrhiza

Total Marks = 60 (IA = 24 + ESE = 36)

(Credits = 02)

#### Unit-I: Mycology-I

1. Significant contributions of Prof. T. S. Sadasivan.
2. **General characters of Fungi** – (i) Vegetative structure (Unicellular and mycelial forms); (ii) Hyphal forms – Plectenchyma, Sclerotia, Rhizomorphs, Haustoria, Appresoria, Stroma & Hyphal trap; (iii) Fungal cell wall – Composition; (iv) Fungal mode of nutrition.
3. **Fungal reproduction** – (i) Holocarpic & Eucarpic fungus; (ii) Vegetative reproduction – Fragmentation, Fission & Budding; (iii) Asexual reproduction - Different asexual spore forms (Zoospores, Conidia, Oidia, Chlamydozoospores & Sporangiospores; (iv) Sexual reproduction - Stages of sexual reproduction (Plasmogamy, Karyogamy & Meiosis), Different methods of Plasmogamy (Gametic copulation, Gametangial contact, Gametangial copulation, Somatogamy & Spermatization); (v) Different types of sexual spores – Ascospores, Basidiospores, Zygozoospores & Oospores.

#### Unit-II: Mycology-II

1. **Classification of Fungi** (Ainsworth, 1973) up to sub-division.
2. **Important characteristics of important fungal groups** –
  - i. Mastigomycotina.
  - ii. Zygomycotina.
  - iii. Ascomycotina (including types of ascocarps and development of ascus and ascospores),
  - iv. Basidiomycotina (including types and development of basidia and basidiospores).
  - v. Deuteromycotina (including types of spores).

#### Unit-III: Mycology-III

1. Structure, reproduction & life cycle of following fungal genera –
  - i) *Rhizopus*
  - ii) *Saccharomyces*
  - iii) *Ascobolous*
  - iv) *Penicillium*
  - v) *Agaricus*
  - vi) *Fusarium*.

#### Unit-IV: Lichen, Myxomycetes & Mycorrhiza

1. **Lichens:** General characters - morphological types, internal structure & reproduction; Ecological and economic importance of lichens.
2. **Myxomycetes:** General characters, Types of Plasmodia, Types of Fruiting bodies.
3. **Mycorrhiza:** Types of Mycorrhizal association, Role of Mycorrhizal fungi in agriculture and Forestry.

**Botany (Major)**  
**SEMESTER-I**  
**Paper-2B (Practical)**  
**BT-102C**

**Total Marks = 40 (IA = 16 + ESE = 24)**

**(Credits = 02)**

Sl. No.	Practical	Marks
1.	Workout on Microbiology	05
2.	Workout on Algae	06
3	Workout on Fungi	06
4.	Identification with reasons (2 x 1½marks)	03
5.	Laboratory Note book	02
6.	<i>Viva voce</i>	02
<b>TOTAL</b>		<b>24</b>

**CONTENTS**

1. Use of Simple and Compound microscope.
2. **Work out on Microbiology:**
  - (a) Gram staining of bacterial population from curd.
  - (b) Demonstration of Sterilization process.
3. Work out of the following algal genera with reproductive structures (Free hand drawing only): *Nostoc* sp., *Oedogonium* sp., *Chara* sp., *Ectocarpus* sp., *Polysiphonia* sp.
4. **Work out of the following Fungi** with reproductive structures (Free hand drawing): *Rhizopus* sp., *Penicillium* sp., *Ascobolus* sp., *Agaricus* sp., *Polyporus* sp.
5. **Identifications:**
  - a) **Permanent slides of Algae:** *Nostoc*, *Volvox* colony, *Oedogonium* dwarf male, *Ectocarpus* with plurilocular sporangia, *Polysiphonia* – cystocarp & tetrasporophyte.
  - b) **Permanent slides of Fungi:** Zygosporangium of *Rhizopus*, Conidiophore of *Penicillium*, T.S. of gills of *Agaricus*, T.S. of basidiocarp of *Polyporus*, Conidia of *Fusarium*.
  - c) **Macro specimen** - Fruitbody of *Agaricus*, *Polyporus*
6. **Laboratory Records:** Student must get the laboratory note books duly signed by the respective teacher during practical classes.
7. **Viva voce:** Questions based on theory and practical syllabus of 1<sup>st</sup> semester.





**Tripura University**  
(A Central University)  
Suryamaninagar  
West Tripura

**Syllabus for**  
**Four Years Undergraduate Programme**  
**Subject: Botany (Minor)**  
**(As per NEP-2020)**

**Year - 2023**



**Tripura University**  
(A Central University)

**Course Structure of Botany (UG Programme)**

**As per NEP-2020 under Tripura University**

**BOTANY (MINOR)**

Year	Semester	Paper	Credits	Total marks	Unit-I	Unit-II	Unit-III	Unit-IV
1st	1st	Paper-1A Theory	3	60 (IA=24+ ESE=36)	Microbiology	Phycology-I	Phycology-II	Mycology
		BT-101M Paper-1B Practical	1	40 (IA=16+ ESE=24)	<i>Based on theory paper 1A</i>			
	2nd	Paper-2A Theory	3	60 (IA=24+ ESE=36)	Bryophyta	Pteridophyta	Gymnosperm	Paleobotany
		BT-102M Paper-2B Practical	1	40 (IA=16+ ESE=36)	<i>Based on theory paper 2A</i>			
2nd	3rd	Paper-3A Theory	3	60 (IA=24+ ESE=36)	Phytopathology	Morphology	Embryology	Plant Anatomy
		BT-201M Paper-3B Practical	1	40 (IA=16+ ESE=24)	<i>Based on theory paper 3A</i>			
	4th	Paper-4A Theory	3	60 (IA=24+ ESE=36)	Taxonomy-I	Taxonomy-II	Plant Ecology	Phytogeography
		BT-202M Paper-4B Practical	1	40 (IA=16+ ESE=24)	<i>Based on theory paper 4A</i>			
3rd	5th	Paper-5A Theory	3	60 (IA=24+ ESE=36)	Biochemistry	Plant Physiology-I	Plant Physiology-II	Evolution
		BT-301M Paper-5B Practicals	1	40 (IA=16+ ESE=24)	<i>Based on theory paper 5A</i>			
	6th	Paper-6A Theory	3	60 (IA=24+ ESE=36)	Cell Biology	Molecular Biology-I	Molecular Biology-II	Genetics
		BT-302M Paper-6B Practical	1	40 (IA=16+ ESE=24)	<i>Based on theory paper 6A</i>			
4th	7th	Paper-7A Theory	3	60 (IA=24+ ESE=36)	Biometry	Plant Breeding	Economic Botany-I	Economic Botany-II
		BT-401M Paper-7B Practicals	1	40 (IA=16+ ESE=24)	<i>Based on theory paper 7A</i>			
	8th	Paper-8A Theory	3	60 (IA=24+ ESE=36)	Plant Biotechnology-I	Plant Biotechnology-II	Pharmacognosy	Biodiversity & Sustainable development
		BT-402M Paper-8B Practicals	1	40 (IA=16+ ESE=24)	<i>Based on theory paper 8A</i>			

**DETAILED COURSE CONTENT OF  
BOTANY (MINOR)**

**1<sup>st</sup> YEAR**

**Botany (Minor)**

**SEMESTER-I**

**Paper-1A- (Theory)**

**BT-101M – Microbiology, Phycology & Fungi**

**Total Marks-60 (IA = 24 + ESE = 36)**

**(Credits-3)**

**Unit-1: Microbiology**

- 1. Virus:** General properties of plant virus and Bacteriophage, Structure of DNA virus (T4 phage); Lytic and lysogenic cycle; Structure of RNA virus (TMV).
- 2. Bacteria:** General characters of bacteria; Morphological forms, Cell structure (in detail), Bacterial reproduction- binary fission and endospore formation, Genetic recombination in bacteria -(transformation, transduction and conjugation).

**Unit-II: Phycology-I**

1. General characters of Algae - Thallus organization, Pigments, Outline classification of Lee (1999) up to phylum, Economic importance of algae, *Spirulina* cultivation.
2. Salient features of Cyanophyceae, Chlorophyceae, Phaeophyceae and Rhodophyceae.
3. Bacillariophyceae (Diatom) - Cell structure, reproduction and economic importance.

**Unit-III: Phycology-II**

**Life history of the following:** *Nostoc*, *Oedogonium*, *Chara*, *Ectocarpus* and *Polysiphonia*.

**Unit-IV: Mycology**

1. General characters of Fungi including fungal mode of nutrition, Classification of Fungi (Ainsworth, 1973) up to sub-division; Economic importance of fungi.
2. Important characteristics of Mastigomycotina, Zygomycotina, Ascomycotina, Basidiomycotina, & Deuteromycotina.
3. General characters of Myxomycetes.
4. Life history of *Rhizopus*, *Penicillium* & *Agaricus*.
5. Mushroom production and harvesting (*Volvariella* sp. and *Pleurotus* sp).

**Botany (Minor)**  
**SEMESTER-I**  
**Paper-1B-(Practical)**

**BT-101M**

**Total Marks- 40 (IA = 16 + ESE = 24)**

**(Credit = 1)**

Sl. No.	Practical	Marks
1.	Workout on Microbiology	07
2.	Workout on Algae or Workout on Fungi*	07
3	Identification with reasons (2 x 2 marks)	04
4.	Laboratory Note book	03
5.	<i>Viva voce</i>	03
<b>TOTAL</b>		<b>24</b>

**CONTENTS**

1. Use of Simple and Compound microscope.
  2. **Work out on Microbiology:**
    - (a) Gram staining of bacterial population from curd.
    - (b) Demonstration of Sterilization process.
  3. **Work out of the following algal genera** with reproductive structures (Free hand drawing only): *Nostoc* sp., *Oedogonium* sp., *Chara* sp., *Ectocarpus* sp., *Polysiphonia* sp.  

**And**

**Work out of the following Fungi** with reproductive structures (Free hand drawing): *Rhizopus* sp., *Penicillium* sp., *Agaricus* sp., *Polyporus* sp.
- \*Algal and fungal specimen should be given alternatively to the students during exam.
4. **Identifications:**
    - a) **Permanent slides of Algae:** *Nostoc*, *Volvox* colony, *Oedogonium* dwarf male, *Polysiphonia* – cystocarp & tetrasporophyte.
    - b) **Permanent slides of Fungi:** Zygosporangium of *Rhizopus*, Conidiophore of *Penicillium*, T.S. of gills of *Agaricus*, T.S. of basidiocarp of *Polyporus*.
    - c) **Macro specimen** - Fruitbody of *Agaricus*, *Polyporus*.
  5. **Laboratory Records:** Student must get the laboratory note books duly signed by the respective teacher during practical classes.
  6. **Viva voce:** Questions based on theory and practical syllabus of 1<sup>st</sup> semester.



# **Tripura University**

**(A Central University)**

**Suryamaninagar**

**West Tripura**

**Syllabus for**

**Four Years Undergraduate Programme**

**Subject: Fundamental Botany**

**(Interdisciplinary course)**

**(As per NEP-2020)**

**Year-2023**



**Tripura University**  
(A Central University)

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**Course Structure of Botany (UG Programme)**  
**As per NEP-2020 under Tripura University**

**FUNDAMENTAL BOTANY**  
**(Interdisciplinary Course)**

Year	Semester/ Paper code	Paper	Credits	Marks	Unit-I	Unit-II	Unit-III	Unit-IV
1 <sup>st</sup>	1 <sup>st</sup> <b>BT-101 ID</b>	Paper-1 Theory	3	100 (IA=40 + ESE=60)	Microbiology	Algae	Fungi & Plant Pathology	Bryophyta & Pteridophyta
2 <sup>nd</sup>	3 <sup>rd</sup> <b>BT-201 ID</b>	Paper-2 Theory	3	100 (IA=40 + ESE=60)	Gymnosperms & Paleobotany	Floral Morphology	Taxonomy	Economic Botany
	4 <sup>th</sup> <b>BT-202 ID</b>	Paper-3 Theory	3	100 (IA=40 + ESE=60)	Plant Anatomy & Ecology	Cytogenetics	Molecular Biology	Plant Physiology

**Interdisciplinary Course: Fundamental Botany  
SEMESTER-I  
Paper-1 (Theory)**

**BT-101 ID - Microbiology & Cryptogamic Botany**

**Total Marks = 100 (IA = 40 + ESE = 60)**

**(Credits = 03)**

**Unit-I: Microbiology**

1. **Virus:** General properties of plant virus, Structure of Bacteriophage (T4 phage), Structure of RNA virus (TMV); Definition of Lytic and Lysogenic cycle.
2. **Bacteria:** General characters of bacteria; Morphological forms, Cell structure, Genetic recombination in bacteria-Transformation, Transduction and Conjugation; Economic importance of bacteria.

**Unit-II: Algae**

1. **Algae:** General characters, Thallus organization; Reproduction in algae – Vegetative, Asexual (spore types) and Sexual (concept of Isogamy, Anisogamy & Oogamy); Salient features of – Cyanophyceae, Chlorophyceae, Bacillariophyceae, Phaeophyceae and Rhodophyceae; Economic importance of algae.

**Unit-III: Fungi and Plant Pathology**

1. **Fungi:** General characters including fungal mode of nutrition; Asexual spore forms and Sexual reproduction; General characters of- Phycomycetes, Ascomycetes, Basidiomycetes and Deuteromycetes; Economic importance of Fungi.
2. **Plant Pathology:** Definition of- Host, Pathogen, Pathogenicity, Pathogenesis, Infection, Incubation period, Inoculum, Inoculum potential, Symptom, Causal complex, Disease cycle, Endemic disease, Epidemic disease, Sporadic disease; Koch's postulates, Types of symptoms - Necrotic, Atrophic, Hypertrophic; Symptoms, Casual organisms, symptoms and Control measures of the following diseases: Late blight of Potato, Brown sport of Rice and Black stem rust of Wheat.

**Unit-IV: Bryophyta and Pteridophyta**

1. **Bryophyta:** General characters including amphibian nature; General idea of Life cycle of Bryophytes; Origin of Bryophytes; Distinctive features of classes – Hepaticopsida, Anthocerotopsida and Bryopsida.
2. **Pteridophyta:** Characteristic features of Pteridophytes; Concept of Homospory and Heterospory; Concept of Eusporangiate and Leptosporangiate pteridophytes; Lifecycle of Pteridophytes (general idea); General characters of the classes Psilophytopsida, Psilotopsida, Lycopsida, Sphenopsida and Pteropsida.





# **TRIPURA UNIVERSITY**

**(A Central University)  
Suryamaninagar-799022**

**Syllabus**

**OF**

**Botany  
(Major & General)**

**Semester III**

**2014**

Semester-III  
Syllabus for B.Sc. Botany (Major)  
(Theoretical)

Paper-BT301H

Full marks-60  
(IA-12, E.S.E.-48)  
Total Lectures - 30  
(Each Lecture-I hr)

**Unit I: Fungi and Plant Resource Utilisation**

**15 Periods**

An outline classification of fungi upto class character (Hawksworth-1995). Economic importance of fungi. Lichens and their significance. Fungal spore form, sexual reproduction and degeneration of sex, Mycotoxins; General account of Phycomycetes, Life history of *Mucor*, *Synctitricum*; General account of Ascomycetes, Life history of *Penicillium*, *Ascobolus*; General account of Basidiomycetes, Life history of *Polyporus*, *Agaricus*; General account of Deuteromycetes, Life history of *Fusarium*, Parasexuality.

Cereal- Rice, Wheat; Pulses- Gram, Moong and Lens; Beverages- Tea and Coffee; Fruits- Mango, Citrus and Papaya; Drug yielding- Cinchona, Rauwolfia, Digitalis and Papaver; Spices- Ginger, Cumin and Clove; Oil yielding- Mustard, Groundnut, Coconut and Linseed; Vegetables- Potato, Radish and Cabbage; Fibre yielding- Cotton and Jute; Timber yielding- Teak and Sal; Sugar yielding- Sugarcane and Sugar beet.

Cultivation of Rice, Jute, Rubber and Tea.

**Unit II: Microbiology and Plant pathology**

**15 Periods**

General characteristics of Plant virus and Bacteriophage, Growth cycle (Lytic, T<sub>4</sub> and Lysogenic,  $\lambda$  virus); Bacteria-Cell structure and Endospore formation, Genetic recombination-Conjugation, transformation and transduction; Disease concepts, Symptoms-necrotic, hypoplastic and hyperplastic; Necrotrophs and biotrophs, mode of pathogenesis, Defense mechanism with special references to phytoalexins, Plant quarantine; Koch's postulates, Symptoms, Causal organisms, Disease cycle and Control measures of Late blight of potato, Brown spot of rice, Black stem rust of wheat and Stem rot of Jute.

Semester-III  
Syllabus for B.Sc. Botany (General)  
(Theoretical)

Paper-BT301P

Full marks-50  
(IA-10, E.S.E.-40)  
Total Lectures - 28  
(Each Lecture-I hr)

**Unit I: Fungi and Plant Resource Utilisation**

**14 Periods**

An outline classification of fungi upto class character (Hawksworth-1995). Economic importance of fungi. Lichens and their significance; General account of Phycomycetes, Life history study of *Mucor*; General account of Ascomycetes, Life history study of *Penicillium*; General account of Basidiomycetes, Life history study of *Polyporus*; General account of Deuteromycetes, Life history study of *Fusarium*.

Cereal- Rice, Wheat; Pulses- Gram, Moong and Lens; Beverages- Tea and Coffee; Fruits- Mango, Citrus and Papaya; Drug yielding- Cinchona, Rauwolfia, Digitalis and Papaver; Spices- Ginger, Cumin and Clove; Oil yielding- Mustard, Groundnut, Coconut and Linseed; Vegetables- Potato, Radish and Cabbage; Fibre yielding- Cotton and Jute; Timber yielding- Teak and Sal; Sugar yielding- Sugarcane and Sugar beet.

Cultivation of Rice, Jute and Tea.

**Unit II: Microbiology and Plant pathology**

**14 Periods**

General characteristics of Plant virus and Bacteriophage; Growth cycle- Lytic ( $T_4$ ) and Lysogenic ( $\lambda$ , virus); Bacteria- Cell structure and Endospore formation, Genetic recombination-Conjugation, transformation and transduction; Symptoms- necrotic, hypoplastic and hyperplastic; Koch's postulates, Symptoms, Causal organisms, Disease cycle and Control measures of Late blight of potato, Brown spot of rice and Black stem rust of wheat.

Semester-III  
Syllabus for B.Sc. Botany (Major)  
2014  
(Practical)

Time: 3 hrs

Full marks-40  
(IA-08, E.S.E.-32)

- |   |             |
|---|-------------|
| 1. Work out on fungi (including measurement)..... | 07          |
| 2. Work out on microbiology.....                  | 07          |
| 3. Identification with reasons.....               | (5x2)=10    |
| a) Plant resource utilization.....                | 2 specimens |
| b) Plant disease.....                             | 2 specimens |
| c) Fungi/Microbiology.....                        | 1 specimen  |
| 4. Laboratory note book with submission.....      | (3+1)=04    |
| 5. Viva-voce.....                                 | 04          |

**Practical – BT302H**

1. Work out of the following fungi with reproductive structures (including microscopic measurement of reproductive structures) *Mucor*, *Ascobolus*, *Penicillium*, *Agaricus*, *Puccinia*, *Polyporus*.
2. Study from permanent slides: Zygosporangium of *Mucor*, Conidiophore of *Penicillium*, Conidia of *Fusarium*.
3. Preparation of bacterial media – (a) Nutrient agar and nutrient broth, (b) Preparation of slants and pouring Petriplates.
4. Sub-culturing of bacterial/fungal culture.
5. Microscopic examination of bacteria from natural habitat (curd) by Gram staining.
6. Preparation of fungal media (PDA).
7. Sterilization process.
8. Inoculation of pathogen from diseased leaf.
9. Identification: Pathological specimens of Brown spot of rice, Loose smut of wheat, Stem rot of jute, Late blight of potato; Slides of uredial, telial, pycnial & aecial stages of *Puccinia graminis*.

**Semester-III**  
**Syllabus for B.Sc. Botany (General)**  
**2014**  
**(Practical)**

**Time: 3 hrs**

**Full marks-50**  
**(IA-10, E.S.E.-40)**

1. Work out on fungi (excluding measurement).....10
2. Work out on microbiology.....10
3. Identification with reasons.....6x2=12
  - a) Plant resource utilization.....2 specimens
  - b) Plant disease.....2 specimens
  - c) Fungi/Microbiology.....2 specimens
4. Laboratory note book with submission.....(3+1)=04
5. Viva-voce.....04

**Practical – BT302P**

1. Work out of the following fungi with reproductive structures (excluding microscopic measurement of reproductive structures) *Mucor*, *Penicillium*, *Polyporus*.
2. Study from permanent slides: Zygosporangium of *Mucor*, Conidiophore of *Penicillium*, Conidia of *Fusarium*
3. Microscopic examination of bacteria from natural habitat (curd) by simple staining.
4. Preparation of fungal media (PDA).
5. Sterilization process.
6. Identification: Pathological specimens of Brown spot of rice, Loose smut of wheat, Stem rot of jute, Late blight of potato; Slides of uredial, telial, pycnial & aecial stages of *Puccinia graminis*.



# **TRIPURA UNIVERSITY**

**(A Central University)  
Suryamaninagar-799022**

## **Syllabus**

**OF**

**Botany (General – V<sup>th</sup> Semester  
&  
Major - V<sup>th</sup> & VI<sup>th</sup> Semester**

**2014**

### Marks Distribution of Vth Semester (Elective)

Semester	Theoretical Marks	Practical Marks	Total Marks
Semester-V	50 (IA-10+ ES-40)	50 (IA-10+ ES-40)	100

\*IA= Internal Assessment; \*ES = End semester Examination

### Course Structure, Vth Semester (Elective)

Course Title	Full Marks
BT – 501(Theory) (Cell and Molecular Biology, Cytogenetics and Plant Breeding, Plant Physiology and Plant Biotechnology)	50
BT – 502 (Practical) Based on Theory Course – BT501	50

## SEMESTER – V

### BT-501 (Theory) Marks: 100 (Elective)

**Internal Assessment: 10**

**40 Periods**

**End Semester Examination: 40**

**20 Periods**

#### **Unit – I: Cell and Molecular Biology, Cytogenetics and Plant Breeding**

Cell cycle and Cell division, Structure and function of Cell Organelles (Nucleus, Mitochondria, Chloroplast, Ribosome) Chromosome morphology and Organization of eukaryotic Chromosome (Nucleosome concept); Structure, forms and salient features of Nucleic Acids (DNA and RNA); DNA replication, Mechanism of DNA replication in Prokaryotes, Transcription: Initiation, elongation and termination in Prokaryotes. Translation in Prokaryotes: Amino-acylation of tRNA, initiation, elongation and termination of polypeptide chain; Gene Mutation: Transition, Transversion and Frame shift mutation, Lac Operon (brief idea).

Mendelian inheritance; Gene interactions: Incomplete Dominance (1:2:1), Modified dihybrid ratio (12:3:1, 9:3:4, 9:7) Crossing Over: Cytological proof of crossing over (McClintock's experiment); Complete and incomplete linkage, Aneuploidy and Euploidy, role of polyploidy in crop improvement; Chromosomal aberration: deletion, duplication, translocation and inversion; Methods of plant breeding: Introduction, emasculation, Hybridization and Acclimatization; Selection: Mass selection and pure selection; Male sterility: Genetic, Cytoplasmic and Cytoplasmic-genetic male sterility, Heterosis and hybrid vigour.

#### **Unit II: Plant Physiology and Plant Biotechnology**

**20 Periods**

Water potential and its components; Water absorption by roots (apoplastic and symplastic pathways); Photosynthesis: photochemical reactions, Mechanism of electron transport in PS-I and PS-II, Calvin cycle; C<sub>3</sub> and C<sub>4</sub> plants and photosynthetic efficiency, photorespiration, Crassulacean acid metabolism (CAM); Transpiration and anti-transpirant. Respiration: glycolysis, Oxidative Phosphorylation, Mitochondrial ETS; N-metabolism: Assimilation of Nitrogen, Biological Nitrogen fixation: role of nitrogenase in N<sub>2</sub> fixation; Photoperiodism: Photoperiodic responses and classification of plants, Photomorphogenesis; Plant growth regulators, physiological role and modes of action (IAA, Gibberellins and Cyokinins).



Totipotency and concept of plant tissue culture; Function and organization of a typical plant tissue culture laboratory; Techniques of plant tissue culture: cell suspension culture technique, protoplast culture technique; Modes of in vitro regeneration and applications; Callus culture and applications; Haploid and embryo culture; Transformation: *Agrobacterium* mediated gene transfer.

## **SEMESTER-V**

### **Practical – 502**

**Full Marks: 50**

**Internal Assessment: 10**

**End Semester Examination: 40**

1. Mitotic Study: Temporary preparation of metaphase chromosomes from root tips of *Allium cepa*
2. Identification with reasons from permanent slides: Different stages of mitosis and meiosis including abnormalities like Sticky Bridge, laggard chromosome(s), chromosomal fragmentation, ring chromosome, early separation.
3. Study of pollen sterility by Aceto-carmin staining technique.
4. Detection of organic acids: citric, tartaric, oxalic and malic acids from unknown samples.
5. Detection of the nature of carbohydrate: glucose, fructose and sucrose from unknown samples.
6. Determination of released oxygen during photosynthesis.
7. To extract and separate chlorophyll pigment by chromatography.
8. Relationship between transpiration and evaporation.
9. Measurement of oxygen uptake by respiring tissue (per g/hr).
10. Effect of temperature on absorption of water by storage tissue and determination of  $Q_{10}$ .
11. Comparison of imbibitions of water by starchy, proteinaceous and fatty seeds.
12. Demonstration and function of autoclave, laminar airflow, pH meter and culture room.
13. Aseptic techniques of explants culture.

#### **Laboratory records:**

2. Laboratory note book of each section must be signed by the respective teacher with date during practical classes.

**Semester-V**  
**Practical - Paper 502**

**End Semester Examination – 40**

**Questions pattern:**

1. Mitotic Study: Temporary preparation of metaphase chromosomes from root tips of material provided 08
2. Identification with reasons (any two – Identification- 1, Reasons -1) (2X2) = 04
3. Experiment on biochemical works as per practical workout 05
4. To perform a major physiological experiment from the list of the experiments as per contents of practical syllabus 10
5. Demonstration on Plant tissue culture technique 05
6. Practical Note Book 04
7. *Viva voce* 04

### Marks Distribution of Vth & VIth Semester (Major)

Semester	Theoretical Marks	Practical Marks	Total Marks
Semester-V	100 (IA-20+ ES-80)	100 (IA-200+ ES-800)	200
Semester-VI	100 (IA-20+ ES-80)	100 (IA-200+ ES-800)	200
Total	200	200	400

\*IA= Internal Assessment; \*ES = End semester Examination

### Course Structure, Vth & VIth Semester (Major)

Course Title	Full Marks
BT – 501(Theory) (Cell Biology, Molecular Biology, Cytogenetics, Plant breeding & Biostatistics)	100
BT – 502 (Practical) Based on Theory Course – BT501	100
BT – 601 (Theory) (Biochemistry, Plant Physiology, Pharmacognosy, Plant Biotechnology)	100
BT – 602 (Practical) Based on Theory Course – BT601	100

## SEMESTER – V (MAJOR)

BT – 501 (Theory) Marks: 100

**Internal Assessment: 20**

**56 Periods**

**End Semester Examination: 80**

**Unit – I: Cell Biology:**

**14 Periods**

Cell cycle and Cell division, equational and reductional division with respect to 'C' value, Cell cycle regulation, Theories of anaphasic movement; Structure and function of Cell Organelles (Nucleus, Mitochondria, Chloroplast, ER, Golgi Apparatus, Peroxisomes and Glyoxysomes, Ultra-structure of ribosome in Prokaryotes and Eukaryotes,) Plasma membrane – Structure (Fluid mosaic model) and function; Chromosome morphology and Organization of eukaryotic Chromosome ( Nucleosome concept); Centromere and telomere – structure and function; Organization of cp and mt DNA and their significance; Apoptosis.

**Unit – II: Molecular Biology:**

**14 Periods**

Structure, forms and salient features of Nucleic Acids (DNA and RNA); DNA replication - Semi-conservative replication in Prokaryotes with proof (Meselson and Stahl's Experiment), Mechanism of DNA replication in Prokaryotes, Genetic code: Properties, deciphering of genetic code; Transcription: Initiation, elongation and termination in Prokaryotes. Translation in Prokaryotes: Amino-acylation of tRNA, initiation, elongation and termination of polypeptide chain; Gene Mutation: Transition, Transversion and Frame shift mutation, Effects of chemical mutagens (Base analogues and Nitrous acid) Physical agents (UV rays); DNA damage and repair, Concept of Lac Operon (Positive and Negative control). Restriction enzymes: types and function; PCR and its application (A brief idea)

**Unit – III: Cytogenetics**

**14 Periods**

Mendelian inheritance; Gene interactions: Incomplete Dominance (1:2:1), Modified dihybrid ratio (12:3:1, 9:3:4, 9:7, 9:6:1, 13:3), Atavism, Pleiotropism; Polygenic inheritance in plant(15:1); Crossing Over: Cytological proof of crossing over (McClintock's experiment); Molecular basis of Crossing Over; Complete and incomplete linkage, Three point test cross, Problems on Gene Mapping; Sex linked trait and sex linked inheritance; Aneuploidy and Euploidy, role of polyploidy in crop improvement; Chromosomal aberration: Types and meiotic behavior of deletion, duplication, translocation and inversion; Molecular mapping- FISH technique; Bioinformatics: Genomics and proteomics (A brief idea).

#### **Unit- IV: Plant Breeding and Biostatistics:**

**14 Periods**

Methods of plant breeding: Introduction, emasculation, Hybridization and Acclimatization; Selection: Mass selection and pure selection; Male sterility: Genetic, Cytoplasmic and Cytoplasmic-genetic male sterility; Heterosis and hybrid vigour; Collection of data (Variable and attribute, Primary and Secondary data, Population and sample); Types of charts and diagrams: Frequency distribution (Simple, Grouped and Cumulative); Measures of Central tendency: Mean Mode and Median; Measure of dispersion: Mean deviation and Standard Deviation; Standard Error; Correlation and Coefficient of Correlation ( $r$ ); Student t- test; Chi Square test for goodness of fit; Classical definition of Probability, Addition and Multiplication rules.

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**Pattern of Question Setting**  
**(Major)**  
**BT-501 & BT-601**

1. Short Questions 10 marks- Compulsory

From the rest of 70 marks, there would 2 questions of 14 marks each from each unit, Candidate will answer any five questions taking at least one from each unit.

Each a unit of 14 marks may be subdivided into 2 to 3 parts having a maximum of eight marks for a part

**SEMESTER – V**  
**Practical Paper– 502**  
**Full Marks: 100**

**Internal Assessment: 20**

**End Semester Examination: 80**

1. Mitotic Study: Temporary preparation of metaphase chromosomes from root tips of *Allium cepa* and *Lens esculenta* and determination of their somatic chromosome number.
2. Study of mitotic index in *Allium cepa* L.
3. Meiotic Study: Temporary preparation of prophase I (Diplotene and diakinesis), Metaphase – I and Anaphase -I from flower buds of *Allium cepa*, *Rhoeo sp* and *Datura sp*.
4. Identification with reasons from permanent slides: Different stages of mitosis and meiosis including abnormalities like Sticky Bridge, laggard chromosome(s), chromosomal fragmentation, ring chromosome, early separation.
5. Study of pollen sterility by Aceto-carmin staining technique.
6. Demonstration of emasculation technique.
7. Graphical representation of statistical Data
8. Statistical analysis of Mean, Mode, Median, Standard deviation, Standard error and T-Test.
9. Determination of goodness of fit in normal and modified dihybrid ratios.

**Laboratory records:**

1. Laboratory note book of each section must be signed by the respective teacher with date during practical classes.



**Semester-V**  
**Practical - Paper 502**

**End Semester Examination - 80**

1. Mitotic Study: Temporary preparation of metaphase chromosomes from root tips of material provided and determination of their somatic chromosome number. 16

2. Study of mitotic index in *Allium cepa* L.

Or

Temporary preparation of meiosis from the supplied material (Any one stage from the suggested practical works) 10

Or

3. Identification with reasons (any three – Identification- 1. Reasons -2) (3X3) = 9

4. Study of pollen sterility by Aceto-carmin staining technique.

Or

Demonstration of emasculation technique 10

5. Statistical analysis of the experimental data as included in the syllabus 15

6. Practical Note Book and Submission of permanent cytological slides (7+3) = 10

7. *Viva voce* 10

## Botany (Major)

### SEMESTER-II

#### Paper-3 (Theory)

#### BT-103C- Bryophyta, Pteridophyta, Gymnosperms & Basic Paleobotany

Total Marks = 100 (IA = 40 + ESE = 60)

(Credits = 04)

#### Unit-I: Bryophyta

1. Significant contributions of Indian Bryologist: Prof. Shiv Ram Kashyap.
2. General characters of Bryophytes.
3. Bryophyta - Adaptations to land habit.
4. Outline Classification - (Crandall-Stotler and Stotler, 2000) up to class.
5. Distinctive features of three major groups – Liverworts (Phylum: Marchantiophyta), Hornworts (Phylum: Anthocerotophyta), and Mosses (Phylum: Bryophyta).
6. Importance of Bryophyta – Ecological significance & economic importance of bryophytes.
7. Gametophyte structure, Reproduction, Development and Structure of sporophyte, Spore dispersal of *Riccia*, *Marchantia*, *Anthoceros*, *Funaria*.

#### Unit-II: Pteridophyta

1. General characters of Pteridophytes.
2. Life cycle pattern (Homosporous and Heterosporous).
3. Apogamy & Apospory.
4. Outline classification (Sporne, 1975) up to Order with example.
5. Important characters of Psilophytopsida, Psilotopsida, Lycopsida, Sphenopsida, and Pteropsida.
6. Morphology, anatomy and reproduction of *Psilotum*, *Lycopodium*, *Selaginella*, *Equisetum*, *Pteris*.

#### Unit-III: Gymnosperms

1. General characters of Progymnosperms, Classification of Progymnosperms, Vegetative and reproductive structures of *Archaeopteris*.
2. General characters of Gymnosperms.
3. Outline classification (Sporne, 1965) up to Order with example.
4. Important characters of Cycadopsida, Coniferopsida, and Gnetopsida.
5. Economic importance with reference to Wood, Resins, Essential oils, and Drugs.
6. Distribution, morphology, anatomy and reproduction of *Cycas*, *Pinus*, *Ginkgo*, and *Gnetum*.

#### Unit-IV: Basic Paleobotanical Principles

1. Significant contributions of Indian Paleobotanist: Dr. Birbal Sahani.
2. Definition of fossil, Conditions required for fossilisation, fossilisation process.
3. Types of fossil (Body fossil - Micro- and Megafossils, Trace fossil, Chemical fossil, Index fossil).
4. Modes of preservation (after Schopf, 1975).
5. Concept of reconstruction and formed genus.
6. Geological time scale with dominant plant groups through ages.
7. Techniques for studying plant fossils.
8. Principles of radiometric fossil dating (brief idea).
9. Importance of fossil study.

**Botany (Major)**

**SEMESTER-II**

**Paper- 4A (Theory)**

**BT-104C- Fossil Plants & Principles of Organic Evolution**

**Total Marks = 60 (IA = 24 + ESE = 36)**

**(Credits = 02)**

**Unit-I: Fossil Plants - I**

1. Study of the following fossil plants:
  - i. *Rhynia*
  - ii. *Lepidodendron*
  - iii. *Calamites*
  - iv. Paleozoic seed fern - *Lyginopteris*
  - v. Mesozoic seed fern - *Caytonia*

**Unit-II: Fossil Plants - II**

1. Study of the following fossil plants:
  - i. *Willimsonia*
  - ii. *Pentoxylon*
  - iii. *Cordaites*
2. Indian Gondwana flora system - Three fold division with major megafossil assemblages.

**Unit-III: Principles of Organic Evolution-I**

1. Origin of life (Oparin-Haldane concept, Urey-Miller experiment, RNA world hypothesis, Protein first model, Origin of proto cells – Sydney Fox's experiment, Proteinoids, Microspheres & Coacervates).
2. Species Concept – Morphological, Ecological, Evolutionary & Biological species concept.
3. Reproductive isolation - Definition and types (pre zygotic & post zygotic isolating mechanisms).
4. Modes of speciation (Allopatric, Peripatric, Parapatric, & Sympatric).
5. Phyletic gradualism, Punctuated equilibrium and Stasis.

**Unit-IV: Principles of Organic Evolution-II**

1. Natural selection - Definition and types (Directional, Stabilizing, Disruptive).
2. Darwinism and its limitations.
3. Neo Darwinism (only brief idea).
4. Sexual selection and Group selection (definition).
5. Coevolution – Definition and example.
6. Macro and Micro evolution (definition).
7. Adaptive radiation and convergence.

**Botany (Major)**  
**SEMESTER-II**  
**Paper-4B (Practical)**  
**BT-104C**

**Total Marks = 40 (IA = 16 + ESE = 24)**

**(Credits = 02)**

<b>Sl. No.</b>	<b>Practical</b>	<b>Marks</b>
<b>1.</b>	Workout on Pteridophyta	<b>06</b>
<b>2.</b>	Workout on Gymnosperm	<b>05</b>
<b>3</b>	Identification with reasons (4 x 2 marks)	<b>08</b>
<b>4.</b>	Laboratory Note book	<b>02</b>
<b>5.</b>	<i>Viva voce</i>	<b>03</b>
<b>TOTAL</b>		<b>24</b>

**1. Work out on:**

- (a) **Pteridophytes:** Workout on reproductive structures of the following Pteridophytes: *Lycopodium* sp., *Selaginella* sp., *Equisetum* sp., *Pteris* sp.
- (b) **Gymnosperms:** Leaflet of *Cycas* sp, *Pinus* sp., Microsporophyll of *Cycas* sp.

**2. Identification:**

- (a) **Morphological study of the Bryophyte genera:** *Riccia*, *Marchantia*, *Anthoceros*, and *Funaria*.
- (b) **Study of Bryophytes from permanent slides** – *Riccia* (V.S. of thallus), *Marchantia* (L.S. of Gemma cup, antheridiophore, archegoniophore, sporophyte), *Anthoceros* (L.S. of sporophyte), *Funaria* (L.S. capsule).
- (c) **Study of macroscopic structures of Gymnosperm:** *Cycas* microsporophylls, *Cycas* megasporophyll, *Pinus* male cone, *Pinus* female cone, *Gnetum* male cone, *Gnetum* female cone.
- (d) **Study of Gymnosperms from permanent slides** – L.S. of *Cycas* ovule, L.S. of *Pinus* male cone, L.S. of *Pinus* female cone, Pollen grains of *Pinus*, L.S. of *Gnetum* male cone, L.S. of *Gnetum* female cone/ovule.
- (e) Study from permanent slides / macroscopic fossil specimen.
- 3. Laboratory Records:** Student must get the laboratory note books duly signed by the respective teacher during practical classes.
- 4. Viva voce:** Questions based on theory and practical syllabus of 2<sup>nd</sup> semester.

## Botany (Minor)

### Semester-II

#### Paper-2A (Theory)

#### BT- 102M – Bryophyta, Pteridophyta & Gymnosperms and Paleobotany

Total Marks-60 (IA = 24 + ESE = 36)

(Credits-3)

#### Unit-I: Bryophyta

1. General characters including Amphibian nature; Origin of Bryophyta.
2. Distinctive features of three major groups – Hepaticopsida, Anthocerotopsida, & Bryopsida.
3. Life history: Gametophyte structure & reproduction, development and structure of sporophyte in of *Riccia*, *Marchantia*, *Anthoceros*, and *Funaria*.

#### Unit-II: Pteridophyta

1. General characters, Lifecycle pattern (Homosporous & Heterosporous type).
2. Outline classification (Sporne, 1975) up to order with examples.
3. Important characters of the classes – Psilophytopsida, Psilotopsida, Lycopsida, Sphenopsida, Pteropsida.
4. Life history: Sporophyte structure, reproduction and structure of gametophyte of *Lycopodium*, *Selaginella*, *Equisetum*, and *Pteris*.

#### Unit-III: Gymnosperms

1. General characters of Progymnosperms.
2. Gymnosperms - General characters.
3. Outline classification (Sporne, 1965) up to Order with examples.
4. Important characters of three classes – Cycadopsida, Coniferopsida, & Gnetopsida.
5. Economic importance of Gymnosperms with reference to Wood, Resins, Essential oils, and Drugs.
6. Life cycle (Morphology, anatomy and reproduction) of *Cycas*, *Pinus* and *Gnetum*.

#### Unit-IV: Paleobotany:

1. Definition of fossil, Conditions required for fossilization, Fossilization process.
2. Types of fossil (Microfossil, Mega fossil and its types on the basis of nature of fossilization); Modes of preservation (after Schopf, 1975).
3. Importance of fossil study.
4. Geological Time scale with dominant plant groups through ages.
5. Study of fossil plants:- *Rhynia*, *Williamsonia*

**Botany (Minor)**  
**Semester-II**  
**Paper-2B (Practical)**  
**BT- 102M**

**Total Marks- 40 (IA = 16 + ESE = 24)**

**(Credit = 1)**

Sl. No.	Practical	Marks
1.	Workout on Pteridophyta	07
2.	Workout on Gymnosperm	07
3	Identification with reasons (2 x 2 marks)	04
4.	Laboratory Note book	03
5.	<i>Viva voce</i>	03
<b>TOTAL</b>		<b>24</b>

**CONTENTS**

**1. Work out on:**

- (a) **Pteridophytes:** Workout on reproductive structures of the following Pteridophytes: *Lycopodium* sp., *Selaginella* sp., *Equisetum* sp., *Pteris* sp.
- (b) **Gymnosperms:** Leaflet of *Cycas* sp, Needle leaf of *Pinus* sp., Microsporophyll of *Cycas* sp.

**2. Identification:**

- (a) **Study of Bryophytes from permanent slides** – *Riccia* (V.S. of thallus), *Marchantia* (L.S. of: Gemma cup, antheridiophore, archegoniophore, sporophyte), *Anthoceros* (L.S. of sporophyte), *Funaria* (L.S. capsule).
- (b) **Study of macroscopic structures of Gymnosperm:** *Cycas* microsporophylls, *Cycas* megasporophyll, *Pinus* male cone, *Pinus* female cone, *Gnetum* male cone, *Gnetum* female cone.
- (c) **Study of Gymnosperms from permanent slides** – L.S. of *Cycas* ovule, L.S. of *Pinus* male cone, L.S. of *Pinus* female cone, Pollen grains of *Pinus*, L.S. of *Gnetum* male cone, L.S. of *Gnetum* female cone/ovule.
- (d) Study from permanent slides/macroscopic fossil specimen.

**3. Laboratory Records:** Student must get the laboratory note books duly signed by the respective teacher during practical classes.

**4. Viva voce:** Questions based on theory and practical syllabus of 2<sup>nd</sup> semester.



# **TRIPURA UNIVERSITY**

**(A Central University)  
Suryamaninagar-799022**

**Syllabus**

**OF**

**Botany  
(General & Major)**

**Semester – IV**

**2014**

**Semester-IV**  
**Syllabus for B.Sc. Botany (Major)**  
**(Theoretical)**

Paper-BT401H,

Full marks-60  
(IA-12, E.S.E.-48)  
Total Lectures - 28  
(Each Lecture-I hr)

**Unit I: Morphology and Embryology, Taxonomy**

**14 Periods**

Morphology- Inflorescence- types with examples, flower types, floral parts- calyx, corolla (Forms and aestivation), stamens (cohesion and adhesion), carpel (Apocarpous and Syncarpous), Placentation types, fertilization process; Fruits- types; Taxonomy- Nomenclature and rules of ICBN, Magnoliaceae, Poaceae, Orchidaceae, Mimosaceae, Caesalpiniaceae, Fabaceae, Malvaceae, Brassicaceae, Solanaceae, Apocynaceae, Lamiaceae, Rubiaceae and Asteraceae; Embryology- Micro and mega sporogenesis (Monosporic, bisporic and tetrasporic) Development of embryo, development of endosperm.

**Unit II: Anatomy, Ecology and Phytogeography**

**14 Periods**

Anatomy-Cell wall (Gross structure and chemical composition), Meristematic and Permanent tissue (structure, distribution and function); Vascular bundles- types, stele- types and evolution, Normal secondary growth ; Anomalous secondary growth (Stems of *Boerhaavia*, *Chenopodium*, *Mirabilis*, *Bignonia*, *Nyctanthes*, Root of *Tinospora*); Ecology- Habitat and Niche (preliminary idea), Ecological succession- Hydrosere and Xerosere, Endemism, Ecological adaptation - Hydrophytes and xerophytes, Red Data Book; Ecological adaptation of Halophytes; Phytogeography- Phytogeographical regions of India (D. Chatterjee-1960); Vegetation of Western and Eastern Himalaya, Sundarban and Tripura.



**Semester-IV**  
**Syllabus for B.Sc. Botany (General)**  
**(Theoretical)**

**Paper-BT401P**

**Full marks-50**  
**(IA-10, E.S.E.-40)**  
**Total Lectures -24**  
**(Each Lecture-I hr)**

**Unit I: Morphology and Taxonomy**

**12 Periods**

Morphology- Inflorescence- types with examples, flower types, floral parts- calyx, corolla (Forms and aestivation), stamens (cohesion and adhesion), carpel (Apocarpous and Syncarpous), Placentation types, fertilization process; Fruits-types; Taxonomy- Magnoliaceae, Poaceae, Orchidaceae, Mimosaceae, Caesalpiniaceae, Fabaceae, Malvaceae, Brassicaceae, Solanaceae, Apocynaceae, Lamiaceae, Rubiaceae and Asteraceae.

**Unit II: Anatomy, Ecology and Phytogeography**

**12 Periods**

Anatomy-Cell wall (Gross structure and chemical composition), Meristematic and Permanent tissue (structure, distribution and function); Vascular bundles- types, stele- types and evolution, Normal secondary growth; Ecology- Habitat and Niche (preliminary idea), Ecological succession- Hydrosere and Xerosere, Endemism, Red Data Book; Phytogeography-Phytogeographical regions of India (D. Chatterjee-1960); Vegetation of Western and Eastern Himalaya and Tripura.

**Semester-IV**  
**Syllabus for B.Sc. Botany (Major)**  
**2014**  
**(Practical)**

Time: 3 hrs

Full marks-40  
(IA-08, E.S.E.-32)

1. Work out on Angiosperm.....	08
2. Work out on Anatomy.....	06
3. Spotting (2no.).....	03
4. Identification with reasons .....(1x4)=04 (Morphology- 1, Ecology- 2, Embryology/Anatomy-1)	
5. Labnotebook and herbarium.....(2+2)=04	
6. Field record.....	03
7. Viva voce.....	04

**Practical - BT402H**

1. Work out on angiospermic plants- specimens to be selected from the families included in the BT 401 Theory paper.
2. Study of anomalous secondary structures with double staining- *Boerhaavia*, *Bignonia*, *Chenopodium*, *Nyctanthes*, Root of *Tinospora*,
3. Identification  
Microscopic study of anatomy: types of stomata, schlerides, types of Raphides, Cystolith, laticiferous duct, Aleurone grain.
4. Identification with reasons:
  - a) Morphology
    - i) Special types of inflorescence
    - ii) Types of stamens
    - iii) Types of Placentation
    - iv) Fruits- types
  - b) Study of adaptive anatomical features- *Nymphaea* petiole, *Nerium* leaf.
  - c) Embryology - Stages of Embryo
5. At least 25 herbarium sheets must be submitted.
6. Students are required to go for at least 2 field study tours.

Semester-IV  
Syllabus for B.Sc. Botany (General)  
2014  
(Practical)

Time: 3 hrs

Total marks-50  
(IA-10, E.S.E.-40)

1. Work out on Angiosperm.....10
2. Work out on Anatomy.....06
3. Spotting identification.....03
4. Identification with reasons .....(4x2)=08  
(Morphology/Embryology/Anatomy-3 Ecology-2)
5. Lab note book and herbarium.....(3+3)=06
6. Field record .....03
7. Viva voce.....04

**Practical - BT 402 P**

1. Work out on angiospermic plants- specimens to be selected from the families included in the theory paper.
2. Study of primary structures- Monocot stem, Dicot stem, Dorsiventral leaf, Isobilateral leaf, Monocot root, Dicot root.
3. Identification
  - a) Morphology
    - i) Types of Placentation
    - ii) Types of fruits
  - b) Types of stomata, Raphides, Cystolithn and Starch grain.
  - c) Aadaptive anatomical features of *Nymphaea* petiole and *Nerium* leaf
4. At least 15 herbarium sheets must be submitted.
5. Students are required to go for at least 1 field study tours.

## SUGGESTED READINGS

1. Angiosperm Phylogeny Group 2003. An update of the Angiosperm Phylogeny Group classification for the orders and families of the flowering plants: APG II. *Botanical Journal of the Linnean Society* 141: 399-436.
2. Crawford, D.J. 2003. *Plant Molecular Systematics*. Cambridge University Press, Cambridge, UK.
3. Cronquist, A. (1981). *An Integrated System of Classification of Flowering Plants*. Columbia University Press, New York.
4. Hollingsworth, P.M., Bateman, R.M. and Gornall, R.J. 1999. *Molecular Systematics of Plant Evolution* Taylor and Francis, London.
5. Judd, W.S., Campbell, C.S., Kellogg, E.A., Stevens, P.F. and Donoghue, M.J. 2008. *Plant Systematics- A Phylogenetic Approach*. Sinauer Associates Inc, Massachusetts, USA.
6. Simpson, M.C. 2006. *Plant Systematics*. Elsevier, Amsterdam.
7. Stussy, T.F. 1990. *Plant Taxonomy*, Columbia University Press, USA.
8. Singh, V. and Jain, D.K., *Taxonomy of angiosperms*. Rastogi Publication, Meerut2.
9. Pandey, B.P., *Angiosperms-Taxonomy, Emrbyology and Anatomy*, S. Chand and Co., New Delhi
10. Raghavan, V. 2000. *Developmental Biology of Flowering plants*, Springer, Netherlands.
11. Raghavan, V. 1997. *Molecular embryology of flowering plants*. Cambridge, University Press.
12. Shivanna, K.R. 2003. *Pollen Biology and Biotechnology*, Science Publishers.
13. Bhojwani, S.S. and Bhatnagar, S.P. 2004. *The Embryology of Angiosperms*, Vikas Publishing House
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15. Dickinson, W.C. 2000. *Integrative Plant Anatomy*. Harcourt Academic Press, USA.
16. Fahn, A. 1974 *Plant Anatomy*. Pergmon Press, USA and UK.
17. Mauseth, J.D. 1988. *Plant Anatomy*. The Benjamin/Cummings Publisher, USA.
18. Esau, K. 1977. *Anatomy of Seed Plants*. Wiley Publishers.
19. Sharma, P.D. 2009. *Ecology and Environment*, (10th Revised Ed.), Rastogi Pub. FIP, Patparaganj, New Delhi-92
20. Edward, J. Kormondy, 2008. *Concepts of Ecology* (4th Ed, 2008) Pearson Education Inc. & Dorling Kindersley Pub, Inc. Capital offset Press, New Delhi
21. Smith, T.M. and Smith, R.L. 2008. *Elements of Ecology*, Benjamin-Cummings, N.Y. (7th Edn.)
22. Miller, G.T., 2004. *Essentials of Ecology*, Brooks, Cole, N.Y. (3rd Edn.)
23. Odum and Barrett, Thomson, Ed. Brooks/Cole, *Fundamentals of Ecology*, Cengage Learning
24. Singh, Singh and Gupta Ed., *Ecology, Environment and Resources Conservation*, , Anamaya Pub., New Delhi
25. Odum, E.P., *Basic Ecology*, Ed. Saunders College Pub.

**BT – 601 (Theory) Marks: 100 (Major)**

**SEMESTER – VI**

**Internal Assessment: 20**

**56 Periods**

**End Semester Examination: 80**

**Unit- I: Biochemistry**

**14 Periods**

Structure and properties of water, co-valent and non-covalent bonds, hydrogen bonds, Vander Waal's forces, pH, buffer and isoelectric points; Carbohydrate: Classification, structure and properties; Lipids: Classification and function; Protein: Classification and structure (Primary, Secondary, Tertiary and Quaternary structure); Amino acids: Structure, charge and polarity; essential amino-acids; Enzyme: Classification and function, Isozymes, Allosteric enzymes and Coenzymes; Glycolysis, conversion of pyruvic acid to Acetyl Co-A, TCA cycle; Membrane chemistry, transport and mechanism of ion uptake; Signal transduction pathway and second messenger concept- G protein.

**Plant physiology:**

**14 Periods**

Water potential and its components; Water absorption by roots (apoplastic and symplastic pathways); Photosynthesis: Components of photosynthesis, Types of chlorophyll and carotenoids and their structures and functions; Red drop effect and Enhancement effect, Antenna complex, photochemical reactions, Mechanism of electron transport in PS-I and PS-II, Calvin cycle; HSK pathway; C<sub>3</sub> and C<sub>4</sub> plants and photosynthetic efficiency, photorespiration, Crassulacean acid metabolism(CAM); Stomatal physiology: role of CO<sub>2</sub> ions, ABA and light, transpiration and anti-transpirant. Respiration: Oxidative Phosphorylation, Mitochondrial ETS and uncouplers, PP pathway; N-metabolism: Assimilation of Nitrogen, Biological Nitrogen fixation: symbiotic fixation; 'nod' genes and 'nif' genes, role of nitrogenase in N<sub>2</sub> fixation; Photoperiodism: Photoperiodic responses and classification of plants, Circadian Clock Photomorphogenesis; Phytochromes as photoreceptor in Photoperiodism, Vernalization, Florigen and transition to flowering; Plant growth regulators, physiological role and modes of action (IAA, Gibberellins and Cyokinins), Brassinosteroids, polyamines.

**Unit – III: Pharmacognosy:**

**14 Periods**

Importance of pharmacognosy in modern medicine; Drugs: crude and commercial drugs; Method of commercial drug production, drug adulteration; Classification and evaluation of drugs:

organoleptic, microscopic, chemical and physical evaluation; Secondary metabolites and secondary metabolic biosynthetic pathways; Major types of secondary metabolites with source plants: Flavonoids, steroids, terpenoids, resins, phenolics and alkaloids; Organoleptic study of whole plant of *Andrographis paniculata*, Bark of *Alstonia* sp., Rhizome of Ginger, Tuber of *Dioscoria* sp., Leaves of *Adhatoda* sp.

#### **Unit – IV: Plant Biotechnology**

**14 Periods**

Totipotency and concept of plant tissue culture; Function and organization of a typical plant tissue culture laboratory; Techniques of plant tissue culture: cell suspension culture technique, protoplast culture technique, Meristem tip culture technique; Modes of *in vitro* regeneration and applications; *In vitro* exudation and remedial Measures; Callus culture and applications; Haploid and embryo culture; Prokaryotic vector system and marker genes; Transformation: *Agrobacterium* mediated gene transfer, Particle Bombardment method.

## Practical BT-602 (H)

Full marks-100

Internal Assessment: 20

End Semester Examination: 80

### SECTION : A

1. Detection of organic acids: citric, tartaric, oxalic and malic acids from unknown samples.
2. Detection of the nature of carbohydrate: glucose, fructose, sucrose and starch from unknown samples.
3. Detection of Ca, Mg, Fe and S from plant ash sample.
4. Estimation of acidity from lemon by titration method.
5. Colorimetric estimation of protein by Folin phenol reagent.

### SECTION: B

6. Estimation of Catalase activity in plant samples.
7. Effect of CO<sub>2</sub> on the rate of photosynthesis.
8. To extract and separate chlorophyll pigment by chromatogram.
9. Determination of loss of water per stomata per hour.
10. Relationship between transpiration and evaporation.
11. Measurement of oxygen uptake by respiring tissue (per g/hr).
12. Determination of the RQ of germinating seeds.
13. Measurement of osmotic pressure of *Rhoeo* leaf by plasmolytic method.
14. Effect of temperature on absorption of water by storage tissue and determination of Q<sub>10</sub>.
15. Comparison of imbibitions of water by starchy, proteinaceous and fatty seeds.

### SECTION : C

16. Study of Palisade ratio and Vein islet no.
17. Chemical tests for Steroids and Alkaloids.
18. Powder microscopy of the plant samples as per contents of the syllabus.

### SECTION: D

19. Demonstration and function of autoclave, laminar airflow, pH meter and culture room.
20. Aseptic techniques of explants culture.

### Laboratory records:

1. Laboratory note book of each section must be signed by the respective teacher with date during practical classes.

## Practical BT-602

Full marks-100

### End Semester Examination: 80

- |   |    |
|---|----|
| 1. Experiment on biochemical works as per practical workout (A)   | 14 |
| 2. To perform a major physiological experiment from the list of the experiments as per contents of practical syllabus (B) | 22 |
| 3. Work out on pharmacognosy (C)  | 12 |
| 4. Demonstration on Plant tissue culture technique (D)  | 12 |
| 5. Practical Note Book  | 10 |
| 6. <i>Viva voce</i>   | 10 |



## Books and references:

1. Plant Cell Tissue and Organ Culture. O.L. Gamborg and G.C. Phillips. Narosa, 1995. ISBN. 81-7319-1018. New Delhi.
2. Plant T Culture: Basic and Applied. T.B. Jha and B. Ghosh. Universities Press. Pvt. Ltd. ISBN.81-73714886. Hyderabad.
3. Plant Tissue Culture. M.K. Razdan. Oxford & IBH Pub. LTD.ISBN. 81-2041571-X.New Delhi.
4. Karp, G. 2010 Cell and Molecular Biology: Concepts and Experiments. 6th edition. John Wiley & Sons. Inc.
5. De Robertis, E.D.P. and De Robertis, E.M.F. 2006 Cell and Molecular Biology. 8th edition.
6. Lippincott Williams and Wilkins, Philadelphia.
7. Cooper, G.M. and Hausman, R.E. 2009 The Cell: A Molecular Approach. 5th edition. ASM
8. Press & Sunderland, Washington, D.C.; Sinauer Associates, MA.
9. Becker, W.M., Kleinsmith, L.J., Hardin. J. and Bertoni, G. P. 2009 The World of the Cell. 7th edition. Pearson Benjamin Cummings Publishing, San Francisco.
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11. Biology of the Gene 6th edition. Cold Spring Harbour Lab. Press, Pearson Pub.
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16. Klug, W.S., Cummings, M.R., Spencer, C.A. (2009). Concepts of Genetics. XI Edition.Benjamin Cummings.
17. Russell, P. J. (2009). *i*Genetics- A Molecular Approach. III Edition. Benjamin Cummings.
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19. Pevsner, J. (2009). Bioinformatics and Functional Genomics. II Edition. John Wiley & Sons.
20. Griffiths, A.J.F., Wessler, S.R., Lewontin, R.C. and Carroll, S.B. IX Edition. Introduction to Genetic Analysis. W. H. Freeman and Co.
21. Gupta, P.K., A Text Book of Cytology, Genetics and Evolution, , Rastogi Publication, Meerut
22. Mukhopadhyay P. (1999): Applied Statistics, New Central Book Agency Pvt. Ltd., Calcutta. 5. Goon A.M., Gupta M.K. and Dasgupta B. (1986): Fundamentals of Statistics, Vol.II, World Press, Calcutta. N.G. Das. Principles of Statistics. Vol I&II.

23. Taize, L & Zeiger, E., 2011, Plant Physiology, Sinauer associates Inc. Publishers, Sunderland, Massachusetts, USA.
24. Hopkins, W.G. , Huner, N.P.A., 2011, Introduction to Plant Physiology, Wiley International Edition, John Wiley & Sons, USA.
25. Srivastava, H.S., 2008, Plant Physiology & Biochemistry, Rastogi publications, Meerut, India.
26. Hopkins, W.G., and Hunter, NPA, 2011, Introduction to Plant Physiology, Wiley International Edition, John Wiley & Sons, USA.
27. Srivastava, H.S., 2008, Plant Physiology & Biochemistry, Rastogi publications, Meerut, India.
28. Buchanan, B., Gruissem, W., & Jones, R.L., 2002, Biochemistry and Molecular Biology of Plants. American Society of Plant Biologists, USA.