

**BOTANY GENERAL COURSE**  
**GAUHATI UNIVERSITY**  
**B.Sc. Syllabus under Semester System**

**Course Structure**

Semester(s)	Course(s)	No. of Papers	Total Marks	No. of Classes/w	Credit (s)
1 <sup>st</sup>	Botany General	01 (E101) Theory	75	6	6
2 <sup>nd</sup>	Botany General	01 (E201) Theory	75	6	6
3 <sup>rd</sup>	Botany General	02 E301-Theory E302-Practical	50+50 (100)	(4+4) 8	(4+4) 8
4 <sup>th</sup>	Botany General	02 E401-Theory E402-Practical	50+50 (100)	(4+4) 8	(4+4) 8
5 <sup>th</sup>	Botany General	02 E501-Theory E502-Practical	100+100 (200)	(8+8) 16	(8+8) 16
6 <sup>th</sup>	Botany General	02 E601-Theory E602-Practical	100+100 (200)	(8+8) 16	(8+8) 16
<b>Total Marks</b>			<b>750</b>	<b>60</b>	<b>60</b>

**FIRST SEMESTER**  
**Allotment of Marks and Credits**

Paper(s)	Course work	Internal Assessment	Total	Credit	Class/week
E 101 (Theory)	60	15	75	6	6
<b>Total</b>	<b>60</b>	<b>15</b>	<b>75</b>	<b>6</b>	<b>6</b>

Examination Time: Theory 3 (Three) Hours

**COURSE CONTENT**

**Paper: E 101(Theory)**

**(Diversity of Microbes and Cryptogams)**

- UNIT I: Introductory Botany: Classification of plant kingdom, Importance of plant for human life and support system
- UNIT II: Algae - General characters, classification, Life history and Economic importance of Cyanophyceae (*Anabaena*), Chlorophyceae (*Volvox*, *Oedogonium*), Phaeophyceae (*Ectocarpus*), Rhodophyceae (*Polysiphonia*)
- UNIT III: Viruses, Bacteria, and Lichen - General account of viruses, Bacteriophages, Transmission of viruses; Classification of bacteria, Ultra structure of bacterial cell, reproduction and economic importance of bacteria; Lichen - General Account and economic importance
- UNIT IV: Fungi and Plant Pathology- General Characters, cellular organizations, nutrition, reproduction, classification, and Economic importance; Life history of Phycomycetes (*Phytophthora*, *Mucor*); Ascomycetes (*Saccharomyces*, *Penicillium*, *Peziza*); Basidiomycetes (*Puccinia*); Deuteromycetes (*Helminthosporium*); Plant disease symptoms, disease cycle and control measures
- UNIT V: Bryophytes - Morphology, structural organization, habit, reproduction, classification and life histories of the following: Hepaticopsida (*Marchantia*); Anthocerotopsida (*Anthoceros*) and Bryopsida (*Funaria*)
- UNIT VI: Pteridophytes - Origin and evolutionary trends, classification, morphological and anatomical characteristics and life cycles of the following: Lycopsidea (*Lycopodium*, *Selaginella*); Sphenopsida (*Equisetum*); Pteropsida (*Pteris*)

**SECOND SEMESTER**  
**Allotment of Marks and Credits**

Paper(s)	Course work	Internal Assessment	Total	Credit	Class/week
E 201 (Theory)	60	15	75	6	6
<b>Total</b>	<b>60</b>	<b>15</b>	<b>75</b>	<b>6</b>	<b>6</b>

Examination Time: Theory            3 (Three) Hours

**COURSE CONTENT**

**Paper: E 201(Theory)**

**(Cell Biology and Genetics)**

UNIT I: Structure of prokaryotic and eukaryotic cell, ultra structure of nucleus, mitochondria, and chloroplast

UNIT II: Chromosome organization - morphology of chromosome, types of chromosome; structure and function of DNA and RNA and their replications

UNIT III: Cell division - Mitosis and meiosis and their significance

UNIT IV: Gene expressions - Structure of genes, protein synthesis, regulation of gene expression in prokaryotic and eukaryotic cell

UNIT V: Mendelian genetics - Laws of segregation and independent assortment, allelic and non-allelic interactions, incomplete dominance

UNIT VI: Linkage and crossing over and their significance; Changes in chromosome structure and number and their role in evolution, mutations- spontaneous and induced

## THIRD SEMESTER

### Allotment of Marks and Credits

Paper	Course work	Internal Assessment	Total	Credit	Class/week
E 301 (Theory)	40	10	50	4	4
E 302 (Practical)	40	10	50	4	4
<b>Total</b>	<b>80</b>	<b>20</b>	<b>100</b>	<b>8</b>	<b>8</b>

Examination Time:	Theory:	3 Hours
	Practical:	4 Hours

### Course Content

#### Paper: E 301 (Theory)

##### (Diversity of Seed Plants and their Systematic)

**UNIT I:** Gymnosperms: Introduction, general characters, classification, Origin & Evolution of seed habit.

**UNIT II:** Morphology of vegetative and reproductive structures, anatomy of stem & leaf, and life cycle of the following types: *Cycas*, *Pinus*, *Gnetum*

**UNIT III:** Fossilization processes, General characteristics of Cycadofilicales, Bennettitales.

**UNIT IV:** Taxonomy of angiosperms: Introduction, Scope and objectives, Binomial Nomenclature, Taxonomic Ranks, General accounts of systems of classification – artificial, natural, phylogenetic. Salient features of classification systems with merits and demerits of Bentham and Hooker; Engler and Prantl.

**UNIT V:** Diversity of flowering Plants: Systematic position (Bentham & Hooker system) distribution, general characters, floral formula, floral diagram, distinguishing characters and economically important plants of the following families.

1. Magnoliaceae, 2. Malvaceae, 3. Papilionaceae, 4. Caesalpinaceae, 5. Mimosaceae, 6. Apiaceae, 7. Euphorbiaceae, 8. Lamiaceae, 9. Solanaceae, 10. Verbenaceae, 11. Asteraceae, 12. Poaceae, 13. Orchidaceae

## Course Content

### **Paper: E 302 (Practical)**

**(Diversity of Microbes and Cryptogams, Cell Biology and Genetics, Diversity of Seed Plants and their Systematics)**

**(Division of Marks: Diversity of Microbes and Cryptogams: 10; Cell Biology and Genetics: 10; Diversity of Seed Plants and their Systematics:10; practical records etc. 5; Viva –voce:5)**

1. Study of vegetative, reproductive bodies of genera included under Algae, Fungi (inclusive of plant diseases) of theory syllabus.
2. Study of morphology, anatomy and detailed reproductive structures of Bryophyta and Pteridophyta genera included under theory syllabus.
3. Gram staining of Bacteria.
4. Examination of stages of Mitotic and Meiotic cell divisions.
5. Gymnosperms: Study morphology and anatomy of leaf/stem, detailed reproductive structures of *Cycas*, *Pinus*, *Gnetum*.
6. Study of fossil specimens and slides.
7. Angiosperms: Description of specimen from representative of locally available plants belongs to the families included in theory syllabus.
8. Submission of Practical Note Books, Permanent slides.
9. Field work report

## FOURTH SEMESTER

### Allotment of Marks and Credits

Paper	Course work	Internal Assessment	Total	Credit	Class/ week
E 401 (Theory)	40	10	50	4	4
E 402 (Practical)	40	10	50	4	4
<b>Total</b>	<b>80</b>	<b>20</b>	<b>100</b>	<b>8</b>	<b>8</b>

Examination Time: Theory: 3 Hours  
Practical: 4 Hours

### Course Content

#### Paper: E 401 (Theory)

#### (Plant Physiology and Biochemistry)

**UNIT I: Plant water relations: Plant-water relations:** Different bio-physio-Chemical phenomenon: definition, phenomenon and Importance of permeability, diffusion, osmosis, Plasmolysis, imbibition, Absorption of water-Introduction, mechanism of water absorption (Active and passive theories), Ascent of sap: Definition, mechanism- (root pressure theory, capillarity, Imbibitional and transpiration pull theories), Transpiration: Definition, types, structure of stomata. Mechanism of opening and closing of stomata (Starch- sugar,  $K^+$  (Potassium ion) pump theory)

**UNIT II: Mineral nutrition:** Essential macro and micro elements and their role in plants (deficiency, symptoms, disease and functions), Translocation of organic solutes: Introduction, direction of translocation, Mechanism: Mass flow or munch hypothesis, protoplasmic streaming theory

**UNIT III: Plant metabolism:** Photosynthesis: introduction, Ultra structure of chloroplast, photosynthetic pigments, concepts of two Photo systems, Light phase: cyclic and non cyclic photophosphorylation (z- scheme), Dark phase: calvin cycle (C3) Hatch and Slack cycle (C4) and crassulacean acid metabolism, significance of photosynthesis, Respiration: Introduction, Types of respiration - Aerobic: Glycolysis, TCA cycle ETS (Oxidative phosphorylation) respiration

**UNIT IV: Growth and Development:** Growth and growth hormones: Phases of growth, factors affecting growth, Plant growth substances, hormones and their Practical applications; Seed dormancy: Introduction, methods

of breaking Seed Dormancy, factors affecting seed dormancy; Physiology of flowering: Photoperiodism (LD/SD/DN plants) Vernalization and Devernalization; Plants movements: Classification of movements, Movements of curvature. Movements of variation (paratonic –nastic)

**UNIT V: Biochemistry:** Elementary biochemistry: Introduction, different organic constituents of the cell, Functions of carbohydrates (mono /oligo / polysaccharides) starch, Cellulose, Hemicellulose, proteins and nucleic acids, lipid, alkaloids, gums, mucilage and organic acids; Nitrogen metabolism: Introduction, physical and biological nitrogen fixation, nitrogen in soil, ammonification and nitrification, denitrification; Enzymes: Introduction, nomenclature and classification, mechanism and mode of action. Concept of holoenzymes, apoenzymes, coenzymes and cofactors.

## COURSE CONTENT

### **Paper: E 402 (Practical)**

#### **(Plant Physiology and Biochemistry)**

1. Determine the osmotic potential of cell sap by plasmolytic method.
2. Determine the Diffusion Pressure Deficit (DPD) of plant cells.
3. Determine the effect of time period on the rate of imbibition in different types of seeds.
4. Determine the relation between absorption and transpiration.
5. Measure the effect of different environmental conditions on the rate of transpiration of a twig by Ganong's Potometer.
6. Determine the effect of CO<sub>2</sub> concentration on the rate of photosynthesis.
7. Determine RQ of different plant materials (Germinating seeds, Leaf buds, Flower buds).
8. Qualitative analysis of plant materials to prove the presence of Sucrose, Glucose, Proteins, Fats and Cellulose.
9. Qualitative analysis of Plant ash to prove the presence of Iron, Potassium, Calcium, Magnesium, Phosphorus.

## FIFTH SEMESTER

### Allotment of Marks and Credits

Paper	Course work	Internal Assessment	Total	Credits	Class/week
E 501 (Theory)	80	20	100	8	8
E 502 (Practical)	80	20	100	8	8
<b>Total</b>	<b>160</b>	<b>40</b>	<b>200</b>	<b>16</b>	<b>16</b>

Examination Time: Theory: 3 Hours  
Practical: 4 Hours

### COURSE CONTENT

#### Paper: E 501 (Theory)

##### (Structure, Development and Reproduction in Flowering Plants)

- UNIT I:** Basic body plan of flowering plant, modular type of growth, diversity in plant forms – annuals, biennials and perennials, Histological organization of root and shoot apices, various theories of cellular organization
- UNIT II:** Types of tissue: Meristematic tissue – meristem, structure and types based on origin and position, Permanent tissue: Simple, Complex and Secretory, Epidermal tissue: Trichomes and Stomata.
- UNIT III:** Anatomy: Primary structure of root, stem and leaf of Monocot and Dicot, Secondary growth in root and stem, Wood anatomy: Growth rings, heart wood and sap wood, Periderm: Origin, structure and functions, Floral biology
- UNIT IV:** Embryology: Microsporogenesis and development of male gametophyte, megasporogenesis and development of female gametophyte, Double fertilization and its significance.
- UNIT V:** Development of dicot embryo, Structure, development and types of endosperms, Fruit: Development and maturation of fruit, types and parts of fruits, fruit dispersal strategies, Vegetative propagation: Grafting, layering and budding.
- UNIT VI:** Seed: Types of seed, germination of seeds-types and nature and dispersal of seeds, factors affecting germination

## **COURSE CONTENT**

### **Paper: E 502 (Practical)**

#### **(Structure, Development and Reproduction in Flowering Plants)**

1. Study of non-living cell inclusion (ergastic matters): Starch grains, Aleurone grains, Raphides, Cystolith.
2. Study of types of stomata.
3. Study of epidermal hairs.
4. Study of secondary growth in thickness by permanent preparation of differentially stained slide: *Amaranthus*, *Boerhavia*, *Mirabilis*, *Bougainvillea*, *Dracaena*, *Tinospora*.
5. Study from permanent slide: T.S. through young and mature anther; Male gametophyte; L.S. of ovule showing different nuclear stages of embryo sac; L.S. of ovule showing types of Endosperm; L.S. of Embryo – Dicotyledonous, Monocotyledonous.
6. Study of spurious fruits, aggregate fruits, composite fruits (at least 2 types each).
7. Study the adaptation in fruits and seeds for dispersal through air (at least 4 types).
8. Demonstrate the process of: Budding; Air layering; Scion grafting.
9. Practical Records, Permanent slides to be submitted in the examination.

## **SIXTH SEMESTER**

### **Allotment of Marks and Credits**

Paper	Course work	Internal Assessment	Total	Credits	Class/week
E 601 (Theory)	80	20	100	8	8
E 602 (Practical)	80	20	100	8	8
<b>Total</b>	<b>160</b>	<b>40</b>	<b>200</b>	<b>16</b>	<b>16</b>

Examination Time: Theory: 3 Hours  
Practical: 4 Hours

### **COURSE CONTENT**

#### **Paper: E 601 (Theory)**

#### **(Ecology and Utilization of Plants)**

#### **Ecology:**

**UNIT I:** Introduction, concept, definition, Autecology and Synecology, Ecosystem

Ecology: Introduction, ecological organization – species population, community ecosystem and biosphere, Kinds of ecosystem, structure and function of ecosystem, abiotic components, biotic components and their role.

**UNIT II:** Ecological succession-Types and pattern, food chain, food web, ecological pyramid

**UNIT III:** Bio-geo-chemical cycles-concept, details of Nitrogen and carbon cycle, Composition and functioning of ecosystem: i) Simple – pond ecosystem, ii) Complex – forest ecosystem, iii) Artificial – crop land ecosystem.

**UNIT IV:** Ecological grouping of plants with reference to their significance of adaptive external and internal features: Hydrophytes and Xerophytes. Environmental pollution with special reference to Air and Water pollutions - causes, effects and control measures; Green house effect.

#### **Utilization of Plants:**

**UNIT V:** Classification of plants on the basis of Botanical sources and uses of Rice, Wheat, Maize,

**UNIT VI:** Sugar cane, Gram, Pea, Coffee and Tea, Black pepper, Turmeric, Clove, and mustard - Their uses and botanical sources

**UNIT VII:** Non timber plant products - Cotton, Jute, Rubber, Bamboo, and Jatropha. Their uses and botanical sources

**UNIT VIII:** Timber and medicinal plant resources: Teak, Sal, Rauwolfia, Neem, Cinchona-their uses and botanical sources

**COURSE CONTENT**  
**Paper: E 602 (Practical)**  
**(Ecology and Utilization of Plants)**

**Ecology:**

1. Determine the frequency and density of herbaceous species by quadrat method
2. Study the anatomical features of some common

**Hydrophytes:** Root of Eichhornia, Petiole of Eichhornia, stem of Hydrilla, Petiole of Nymphaea.

**Xerophytes:** Leaf of Nerium, Leaf of Thevetia, Leaf of Grass.

3. Test for the presence of inorganic salts in the soil: Chloride, Sulphate, Phosphate.

**Utilization of Plants:**

1. Study the morphology, parts used, chemical nature and uses of the following plants
  - a) Cereals – Rice.
  - b) Pulses and legumes – Pea.
  - c) Beverages – Tea.
  - d) Fibres – Cotton, Jute
  - e) Fats and oils –Mustard.
  - f) Spices – Black pepper, Turmeric.
  - g) Medicinal – Rauwolfia, Neem.
  - h) Fuel – Jatropha.
  - i) Sugar-Sugar cane

# BOTANY GENERAL COURSE

## REFERENCES

### FIRST SEMESTER

#### PAPER: E 101

#### ALGAE

1. Mitra J. N., Mitra D & Chaudhuri S. K: Studies in Botany (Vol. I)
2. Pandey, B.B : A Text Book of Botany - Algae.
3. Sharma. O.P : Text Book of Algae
4. Singh, S.K. & S. Srivastava : A Text Book of Algae.
5. Vashishta, B.R : Botany for degree students –Algae.

#### FUNGI

1. Dube., H.C. : A Text Book of Fungi.
2. Mitra J. N., Mitra D & Chaudhuri S. K: Studies in Botany (Vol. I)
3. Sharma, O.P. : Text Book of Fungi.
4. Srivastava, J.P. : An introduction of Fungi.
5. Vashista, B.R. : Botany for Degree students. Part II. Fungi.

#### VIRUS

1. Biswas,S.B. & A. Biswas : An Introduction to Virus.
2. Mitra J. N., Mitra D & Chaudhuri S. K: Studies in Botany (Vol. I)

#### BACTERIA

1. Mitra J. N., Mitra D & Chaudhuri S. K: Studies in Botany (Vol. I)
1. Singh, V. & V. Srivastava : Introduction of Bacteria.

#### PLANT PATHOLOGY

1. Pandey, B.P. : Plant Pathology, Pathogen and Plant Diseases.
2. Rangaswami, G. : Diseases of Crop Plants of India.
3. Sharma, P.D. : Plant Pathology.
4. Singh, R.S. : Plant Diseases.
5. Singh, R.S. : Introduction to Principles of Plant Pathology.

#### BRYOPHYTES

1. Mitra J. N., Mitra D & Chaudhuri S. K: Studies in Botany (Vol. I)
2. Parihar, N.S : An Introduction to Embryophyta.
3. Puri, P. : Bryophytes.
4. Rashid, A. : An Introduction to Bryophyta.
5. Vashishta, B.R. : Botany for degree student –Bryophyta.

#### PTERIDOPHYTES

1. Mitra J. N., Mitra D & Chaudhuri S. K: Studies in Botany (Vol. I)
2. Pandey, B.P. : A Text Book of Bryophyta, Pteridophyta

- and Gymnosperms.
3. Parihar, N.S. : An introduction to Embryology. Vol-II. Pteridophyta and Gymnosperms
4. Rashid, A. : Pteridophyta.
5. Vashishta, P.C. : Botany for Degree Students, Vol IV – Vascular Cryptogams (Pteridophyta),

## SECOND SEMESTER

### PAPER: E 201

#### CELL BIOLOGY

1. Power, C.B. : Cell Biology.

#### CYTOGENETICS

1. Gupta, P.K. : Genetics.
2. Verma, P.S. & V.K. Agarwal : Genetics.

## THIRD SEMESTER

### PAPER: E 301

#### GYMNOSPERM

1. Chamberlain, C.J : Gymnosperm, Structure and Evolution.
2. Mitra J. N., Mitra D & Chaudhuri S. K.: Studies in Botany (Vol. I)
3. Vasishta, P.C : Gymnosperm.

#### PALAEOBOTANY

1. Arnold, C.A : An Introduction to Paleobotany
2. Shukla.A.C. & S.P. Mishra : Essentials of Palaeobotany.

#### PLANT TAXONOMY AND SYSTEMATIC BOTANY

1. Mitra, J.N. : An Introduction to Systematic Botany and Ecology.
2. Mondal, A.K. : Advanced Plant Taxonomy.
3. Mukherjee, S.K. : College Botany (Vol. III).
4. Pandey, P.B : Taxonomy of angiosperms (Systematic Botany)
5. Vashista, P.C : Taxonomy of Angiosperms.

## **FOURTH SEMESTER**

### **PAPER: E 401**

#### **PLANT PHYSIOLOGY**

1. Mitra J. N., Mitra D & Chaudhuri S. K.: Studies in Botany (Vol.II)
2. Mukherji, S, & A.K. Ghosh : Plant Physiology.
3. Verma, V. : A Text Book of Plant Physiology.

## **FIFTH SEMESTER**

### **PAPER: E 501**

#### **PLANT ANATOMY**

1. Mitra J. N., Mitra D & Chaudhuri S. K: Studies in Botany (Vol.I)
2. Pandey, B.P. : Plant Anatomy.
3. Vashista, P.C. : A text Book of plant Anatomy.

#### **EMBRYOLOGY OF ANGIOSPERMS**

1. Bhojwani, S.S & S.P. Bhatnagar : The Embryology of Angiosperms.
2. Dwivedi, J. N. : Embryology of Angiosperms.
3. Johri, B.D. : Embryology of Angiosperms.
4. Maheshwari, P. : An Introduction to the Embryology of Angiosperms.
5. Pandey, B.P. : Embryology of Angiosperms.
6. Pandey, S.N. & A. Chadha : Plant Anatomy & Embryology.

## **SIXTH SEMESTER**

### **PAPER: E 601**

#### **ECOLOGY**

1. Samba Murty, S. : Ecology
2. Sharma, P.D : Ecology and Environment.
3. Shukla, R.S & I.P.S. Chandel : Plant Ecology and Soil Science.
4. Shukla,R.S. & P.S. Chandel : A Text Book of Plant Ecology
5. Samba Murty, S. : Ecology
6. Vasishta, P.C. : Plant Ecology.
7. Verma, V. A. : Text Book of plant Ecology.

#### **ECONOMIC BOTANY**

1. Govind Prakash and S.K. Sharma : Introductory Economic Botany.
3. Nehra, S. : Economic Botany.
4. Pandey, B.P. : Economic Botany.
5. Pandey & Chaddha : Economic Botany
6. Subramanyam, Samba Murty : Economic Botany