ST ALOYSIUS COLLEGE (AUTONOMOUS), MANGALURU – 575 003

Re-accredited by NAAC with 'A' Grade – CGPA 3.62
Recognised as Centre for Research Capacity Building under UGC- STRIDE
Recognised by UGC as 'College with Potential for Excellence'
College with 'STAR STATUS' conferred by DBT, Govt. of India

B.Sc BOTANY

CHOICE BASED CREDIT SYSTEM

(2020-21 ONWARDS)

PREAMBLE

St Aloysius College is named after St Aloysius Gonzaga. It is a Jesuit premier institute in Mangaluru, Karnataka, known for its rich heritage and quality education with a history of 140 years. The institution over the years has trained thousands of young men and women preparing them for life and presenting them to the nation. The institution has been able to redefine and reinforce the purpose of various innovations that have been initiated every year. The College has set high expectations and goal for all its learners and then tries in every possible way to help them to reach those goals. The College affiliated to Mangaluru University, was granted Autonomous status in the year 2007-2008.

In the field of Biological sciences, at the undergraduate level, the optional Botany has carved a niche from times immemorial. Many subjects like Biotechnology, Pharmacognosy, Microbiology, and Biochemistry have got their contributions and share from the traditional subject Botany. Botany with its strong fundamentals can only make the allied combinations more meaningfull, fruitful and complete. In this context St Aloysius College has designed the course content of Botany to meet the needs of the present day students and enable them to join jobs, higher studies and research.

PROGRAMME SPECIFIC OUTCOMES:

On Completion of this Course students will be able to

- get an opportunity in further studies, research and employment in various areas of plant sciences.
- enhance their knowledge in the field of life sciences and are able to handle laboratory equipments and experimentation for higher education leading to research
- enhance the scope of employability by obtaining all-round knowledge in the allied subjects along with Botany.
- develop an awareness towards the environment, biodiversity, conservation and their significance.
- promote and popularize the study of Botany for its importance and its social relevance
- equip themselves for competitive examinations
- inculcate an interest for nature and the need to preserve the nature by maintaining green house, herbal gardens in the campus and environs

COURSE STRUCTURE

Scheme of Choice Based Credit System for B.Sc in Botany

Subjects	Paper	Instruction hours /week	Duration of Exam in hours	Marks			Credits
				IA	Exam	Total	
First Semester Theory	**G507.1** Virus, Bacteria &Algae	4	3	20	80	100	2
Elective	**G507.1 E** Organic farming	2	2	10	40	50	1
Practical	**G507.1P**	3	3	10	40	50	1
Second Semester Theory	**G507.2** Fungi, Plant pathology ,Bryophytes, and Plant Anatomy	4	3	20	80	100	2
Elective	**G507.2 E** Plant Nutraceuticals	2	2	10	40	50	1
Practical	**G507.2P**	3	3	10	40	50	1
Third Semester Theory	**G507.3** Pteridophytes, Gymnosperms , Morphology and Embryology of Angiosperms	4	3	20	80	100	2
Elective	**G507.3E** Medicinal Botany	2	2	10	40	50	1
Practical	**G507.3P**	3	3	10	40	50	1
Fourth Semester Theory	**G507.4** Plant Taxonomy,Ethnobotany and Economic Botany	4	3	20	80	100	2
Elective	**G507.4E** Nursery Management and Gardening	2	2	1 0	40	50	1
Practical	**G507.4P**	3	3	10	40	50	1

Subjects	Paper	Instruction hours /week	Duration of Exam	Marks			Credits
				IA	Exam	Total	
Fifth Semester Theory	**G507.5a** Plant Ecology & Sustainable Development	3	3	20	80	100	2
Theory	**G507.5b** Cytogenetics & Molecular Biology	3	3	20	80	100	2
Practical	**G507.5P**	4	4	20	80	100	2
Sixth Semester Theory	**G507.6a** Plant Physiology	3	3	20	80	100	2
Theory	**G507.6b** Plant Biotechnology, Phytochemistry and Pharmacognosy	3	3	20	80	100	2
Practical Components							
A	Practical **G507.6P**	2	2	10	40	50	1
B	Project-**G507.6 PR**			10	40	50	1
C	Independent Practical Skill Development (IPSD)-**G507.6P**	2	2	10	40	50	1

Total Credits - 28

BSc SEMESTER – I
G507.1 VIRUS, BACTERIA &ALGAE

48 HOURS - 4 HRS/ WEEK

Course outcomes:
On Completion of this Course students will be able to

- acquire the basic knowledge of classification in lower groups of organisms
- understand the structure (thallus, reproductive structures), composition (cell wall and spores) of lower groups of organisms
- classify algae up to the level of a family
- identify cyanobacteria and algae at the level of orders
- to understand the applications in the fields of virology, bacteriology and phycology

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UNIT 1 DIVERSITY AND CLASSIFICATION **12HRS**

1.1 Diversity& classification: Importance, Introduction of terms prokaryotes and eukaryotes with examples. Two, three and four kingdom classification in brief and five kingdom classification of living organisms in detail with salient features and examples.

General classification of plants and introduction of the following terms – Cryptogams & Phanerogams

Cryptogams -Thallophyta, Bryophyta, Pteridophyta, Tracheophyta with examples.

Phanerogams (spermatophyta) - Gymnosperms, Angiosperms with examples.

1.2 Virus: Introduction, history, definition, characteristic features, classification of virus based on host, LHT classification (cryptogram), Baltimore classification (based on genetic material), structure of plant virus- TMV, Phages –T_4 , Mode of transmission of virus.

1.3 Multiplication: Steps involved in replication of RNA virus-TMV (including flow chart of replication of genetic material) DNA virus-T_4 -lytic and lysogenic cycle (including flow chart of replication of genetic material)

Significance and application of viruses in genetic recombination

1.4 Viral plant diseases: Tobacco mosaic disease in bean/cucumber or on any host, Vein clearing disease, Bunchy top of Banana and Katte disease of Cardamom

Viroids: A brief note with examples and significance

UNIT 2 BACTERIA **12HRS**

2.1 Bacteria: Occurrence, A Brief note on Bergy's Classification, Morphology, Flagellation, Ultra Structure of Bacterial cell, Endospore formation and note on germination

Nutrition in bacteria: Autotrophic bacteria (types of photo and chemoautotrophs), Heterotrophic bacteria, Reproduction - binary fission

2.2 Genetic recombination in bacteria: Conjugation, Transformation and Transduction

Actinomycetes: General characters with examples and significance

2.3 Economic Importance: Beneficial aspects and harmful aspects, Diseases in plants, animals and human beings (five examples of each, mention only)

Diseases in Plants: Citrus canker, Soft rot of vegetables (carrot) and Crown gall disease

2.4 Mycoplasma General Characters, Structure, Reproduction and Importance – Mention of diseases in Plants. Detailed study of Little leaf of Brinjal, Grassy-Shoot disease of Sugarcane, Sandal spike, Yellow leaf disease of Coconut and Arecanut.

UNIT 3 CYANOBACTERIA & ALGAE **12HRS**

3.1 Cyanobacteria Introduction, general account on habit and habitat, range of thallus structure, Stanier Classification (1973), Structure of Cyanobacterial cell

Reproduction: Vegetative - fission, fragmentation and hormogones, Asexual reproduction - endospores, exospores, nannospores, akinetes.

3.2 Thallus structure: ***Gloeocapsa, Spirulina, Oscillatoria, Nostoc, Rivularia, Gloeotrichia, Scytonema*** and ***Stigonema.***

Economic Importance: Beneficial aspects and harmful aspects – *Spirulina* protein, cyanobacteria in *Azolla* as fodder and biofertilizer, Algal bloom

3.3 Algae: Habit and Habitat, Range of Thallus organisation, General characteristics of algae, Fritsch's classification (1935) with salient features of each class.

Chlorophyceae:

***Chlamydomonas*:** Cell structure, Asexual reproduction- Zoospores, Aplanospores and Palmella stage, Sexual Reproduction- Iso, Aniso and Oogamous types

3.4 *Pandorina* and *Eudorina:* Thallus construction

***Volvox* -** Thallus organisation, Reproduction - Asexual and Sexual types

***Hydrodictyon*:** Thallus Organisation

UNIT 4 : ALGAE (CONTINUED) 12HRS

4.1 ***Oedogonium*****:** Thallus organisation, Asexual reproduction**:** Zoospores. Sexual Reproduction- Macrandrous type and Nannandrous type

Spirogyra**:** Thallus Organisation

Cladophora- Thallus organisation, haplo- diplontic life cycle

4.2 ***Chara*****:** Thallus organisation and Sex organs

Caulerpa: Thallus variation in different species

Bacillariophyceae: Structure of pennate and centric diatoms

4.3 Phaeophyceae

Sargassum: Thallus organisation, Sexual reproduction: Receptacles- Structure of Male conceptacles and Female conceptacles

4.4 Rhodophyceae:

Polysiphonia: Thallus organisation and Reproduction - structure of Spermatangia, Carpogonia, Cystocarp and Tetrasporophyte along with graphical representation of the life cycle

Economic importance of algae: Beneficial and harmful aspects -Food and energy, agar, carrageenin, alginate, fodder, dyes, diatomite, algal blooms, parasitic algae

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2. Pandey B. P, 2014, College Botany: 1: Algae, Fungi, Lichens, Bacteria, Viruses, Plant Pathology, Industrial Microbiology and Bryophyta , S. Chand Publishing, Twentieth edition, New Delhi.
3. Singh V., 2010, Textbook of Virology, BDC Publishers, New York.
4. Smith K.M. 2012, A Textbook of Plant Virus Diseases , Academic Publication.
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7. Pandey S. N. & P. S. Trivedi. 1977, A Text Book of Botany Vol I ,Vikas Publication
8. Gangulee Das & Datta 2002, College Botany Vol II Ncba (P) Ltd
9. Kumar H. D. & H.N. Singh. 1996, A Text Book of Algae, East West Press. New Delhi.
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14. Purohit S. S 1989, Viruses, Bacteria & Mycoplasmas, Agrobotanical Publ.
15. Rangaswami G. 1972, Diseases of Crop Plants in India. Prentice Hall of India Pvt Ltd New Delhi.
16. Sharma K., 2007, Manual of Microbiology tools & Techniques , Ane,s Student editions
17. Singh R. S. 1963, Plant Diseases 2nd edition. Oxford & IBH.
18. Smith G. M. 1955, Cryptogamic Botany Vol I. Algae & Fungi. Mcgraw Hill Book Co. Inc. 2nd edition.
19. Smith K. M 1990, Plant Viruses 6th edition Universal Book Stall New Delhi.
20. Srivastava H.N. 2005, A Text Book of Botany, Algae. Pradeep Publications, Meerut
21. Vashista, B. R., 1988, Botany for Degree Students-Algae. S. Chand & Co., (P) Ltd., New Delhi.
22. Vashistha B.R., Sinha A. K. & Singh V.P. 2004**,** Botany for Degree Students, Algae S. Chand & Co., (P) Ltd., New Delhi.

B.Sc SEMESTER – I

G507.1P VIRUS, BACTERIA & ALGAE

(PRACTICALS OF 3 HRS EACH, 1 PRACTICAL PER WEEK)

1. Compound Microscope/ dissection microscope - instructions with regard to handling, using, care, cleaning, mounting and precautions, Technique of Temporary Mount.
2. Viral diseases in plants - Mosaic disease in bean/cucumber or any host, Vein clearing disease, Bunchy top of Banana and Katte disease of cardamom, Bacterial diseases in plants: Citrus canker, Soft rot of vegetables (carrot) Mycoplasmal diseases in plants - Little leaf of Brinjal (natural specimens or photographs).
3. Culture of bacteria: Preparation of culture medium - nutrient agar medium, sterilization techniques- alcohol, oven, incubator, autoclave, laminar air flow
4. Isolation techniques of Bacteria - Streak plate technique, gram staining, study of bacteria in curds and root nodules
5. Cyanophyceae - ***Nostoc, Oscillatoria, Rivularia*** **and** ***Scytonema.***
   Protista - Diatoms (pennate and centric) and Desmids (***Cosmarium*** and ***Closterium***).
6. Phytoplankton count from fresh water samples
7. Algae - ***Chlamydomonas, Volvox***- daughter colonies, colony with antheridia, oogonia and zygotes, ***Spirogyra, Cladophora*** (only morphology)
8. Algae - ***Oedogonium*** – morphology, hold fast, cap cells, macrandrous and nannandrous type of reproduction, ***Caulerpa*** - species variations, (only morphology**)**
9. Algae - ***Chara*** - morphology and sex organs, ***Sargassum*** - Morphology and V. S of male and female conceptacles
10. Algae -***Polysiphonia*** -Morphology and Spermatangia, Cystocarp and Tetrasporophyte
11. Collection of specimens / field visit
12. Practical test

B.Sc SEMESTER – I

G507.1E ORGANIC FARMING

Choice based credit system – **Intradisciplinary -** An elective Course which is supportive to the discipline of study **30 Hours (2 hrs/week)**

Course outcomes:

On completion of this course student will be able to

- understand the concept and importance of organic farming
- maintain and improve soil health condition
- understand sustainable management of natural resources

UNIT 1 **15 hrs**

1.1 Organic farming: Introduction and scope, Advantages and limitations of Organic farming. A brief note on Biofertilizers – Mycorrhiza, Cyanobacteria, *Azolla, Rhizobium.*

1.2 Compost : Segregation of biodegradable and non biodegradable waste Biocompost- Preparation techniques of each of the following : Organic compost, mulching, wet and dry method, slurry, nutrient solution, cow dung, neem cake, kitchen waste management, vermicompost , biogas

Demonstration of Vermicompost and biogas

A brief note on sewage treatment plants (STP) , role of STP in recycling water

UNIT 2 **15 hrs**

2.1 Mineral nutrition- Role of macronutrients and micronutrients with examples

Cultivation practices- crop rotation (Paddy and legume), monoculture (Rubber, cashew, tapioca), mixed farming, integrated farming

2.2 Integrated pest management- Biopesticides- *Trichoderma*, Role of *Trichoderma* in controlling the Pepper wilt disease and other soil borne pathogens, role of *Strychnus nux- vomica , Calotropis gigantea, Azadirachta indica* leaves in the control of pest and fungal pathogens, Concept of weed and its management- *Parthenium , Eichhornia, Chromolaena*

REFERENCES

1. Bradley F.M, Ellis B.W, Philips E. 2019. Ultimate encyclopedia of Organic farming-New edition
2. Martin D.L. 2018. Rodale's Ultimate Encyclopedia of Organic Gardening. Penguin random House
3. The Complete Book on Organic Farming and Production of Organic Compost NPCS Board of Consultants & Engineers , Asia Pacific Business Press Inc.
4. Mukherjee A, Dutta S, Goyal T.M , Kapoor A and Mendiratta D. 2017. Organic Farming in India Status, Issues and Way Forward. Academic foundation, New Delhi.

B.Sc SEMESTER II

G 507.2 FUNGI, PLANT PATHOLOGY, BRYOPHYTES AND PLANT ANATOMY

48 HOURS - 4 HR/ WEEK

Course outcomes:

On Completion of this Course students will be able to

- understand the structure, reproduction and economic importance of fungi and bryophytes
- compare and contrast the groups algae, fungi and bryophytes
- evaluate the interaction between different groups of organisms like plant-microbes that occurs in nature.
- get knowledge on symptoms and control measures of plant diseases caused by fungi, algae, and nematodes
- understand the anatomical features of higher plants.

UNIT 1: FUNGI **12HRS**

1.1 Fungi- Introduction and origin, differences between algae and fungi, general account on habit and habitat, Classification by Ainsworth (1971) up to classes with salient features and examples for each class.

Ecological Groups of Fungi- Brief account on Soil, Folicolous, Lignicolous, Entamogenous, Coprophillous, Aquatic, Cellulose decomposing fungi and Dermatophytes.

Types of Nutrition- Saprophytes, Parasites, Symbionts and Predacious Fungi

Vegetative organisation and Reproductive Structures - Asexual and Sexual

1.2 *Phytophthora*: Structure and Asexual Reproduction

Rhizopus: Structure, Reproduction -Asexual and Sexual Types, Heterothallism

Penicillium: Structure and Reproduction -Asexual stage

***Peziza*:** Structure of Fruiting Body -Apothecium

***Xylaria*:** Structure of Stroma, Perithecium

1.3 *Puccinia*: Life Cycle in Primary and Secondary Hosts (Rust Desease in Wheat)- Uredospores, Teleutospores, Basidiospores, Pycniospores and Aeciospores

***Agaricus*:** Life Cycle -Vegetative and Fruiting Body, Gill anatomy, Development of Basidiospores

Mushroom Culture: (Oyster Mushroom) - Compost Preparation, Filling**,** Spawning, Casing, Cropping and Harvesting, Nutrient Value

Fusarium: Morphology and asexual stage

1.4 Economic Importance of Fungi

Beneficial Aspects – Food, Industry and Medicine

Harmful Aspects – Plant diseases, poisonous fungi

Lichens: types, Vegetative propagation and sexual reproduction, Economic Importance of lichens

UNIT 2 PLANT PATHOLOGY **12HRS**

2.1 Plant Microbial Interactions: Introduction, types

Negative interactions: Diseases of some important crops

Pathogenesis, causative organisms, types of symptoms, etiology and control measures of **Mycopathology:** Blast disease of rice, Stem bleeding and Bud rot of coconut, Tikka disease of ground nut, White thread blight of cocoa, Rust disease of wheat, Smut of Cereals,

2.2 Red rot of sugarcane, Powdery mildew of cereals, Coffee rust, and Koleroga of arecanut.

Fruits and Vegetables: White rust of crucifers, Late blight of Potato, Powdery mildew and Downy mildew of grapes.

2.3 Phycopathology: Red rust of Pepper

Nematopathology: Root knot of Tomato / Brinjal

An account of biopesticides and biocontrol

2.4 Positive interactions

Mycorrhizae: Introduction, types, general account on ecto and endomycorrhizae and significance, Isolation techniques- from soil and roots.

UNIT 3 BRYOPHYTA **12 HRS**

3.1 Bryophyta General account on Habit, Habitat, Plant body - Gametophyte, reproduction, sporophyte, alternation of generations, resemblances and differences of bryophytes with algae and pteridophytes,Classification (Rothmaler, 1951), Salient features of classes with examples for each class

3.2 ***Riccia***: Morphology of gametophyte, anatomy of thallus, sexual reproduction –structure of sex organs and sporophyte

Porella: Morphology of Gametophyte

3.3 ***Anthoceros*****:** Morphology of Gametophyte, Anatomy of Thallus, Sexual Reproduction – structure of Sex Organs and Sporophyte with evolutionary significance

3.4 Moss: Morphology of gametophyte, sexual reproduction – structure of antherdial and archegonial clusters, sporophyte and spore dispersal mechanism

Evolutionary trends in Bryophytes

UNIT 4 PLANT HISTOLOGY AND ANATOMY **12 HRS**

4.1 Histology: Meristematic Tissues: Apical, intercalary & lateral meristems , Primary and secondary meristems theories of meristems- shoot apex theory- tunica corpus theory, root apex theory -histogen theory

4.2 Permanent Tissues: Structure, distribution, types and functions of Simple permanent tissues - parenchyma, collenchyma, sclerenchyma, and complex permanent tissues- xylem and phloem

4.3 Anatomy: Differentiation of cells/tissues, a note on nodal anatomy

Primary structure of dicot stem, monocot stem, dicot root, monocot root, dicot leaf and monocot leaf.

4.4 Secondary growth: in dicot stem and dicot root. Wood Anatomy, components of secondary xylem, classification of wood, Commercial wood species of South India – Sandal, Teak, Rose wood, Mahagony, Jack. Dendrochronology and its Applications.

A brief note on anomalous secondary growth in *Bignonia*

REFERENCES

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3. Aneja K.R. 1966, Experiments in Microbiology, Plant Pathology, Tissue Culture and Mushroom Cultivation 2nd edition Vishwa Prakashan, New Delhi.
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BSc SEMESTER II

G 507.2P FUNGI, PLANT PATHOLOGY, BRYOPHYTES, AND PLANT ANATOMY

[PRACTICALS OF 3 HRS / WEEK]

1. ***Phytophthora, Rhizopus, Penicillium-*** Asexual Stages
2. ***Xylaria*** Stroma, ***Peziza*** Apothecium - morphology and anatomy , ***Puccinia*** - Uredostage, Teleutostage, Pycniostage and Aeciostage
3. Plant Pathology - **Crops**: Blast disease of rice, stem bleeding and bud rot of coconut, Kole Roga of Arecanut, Tikka disease of ground nut, Red rust of Pepper, Coffee rust
   Vegetables: White Rust of Cruciferae
   Nematopathology: Root Knot of Tomato/Brinjal
4. Lichens - Types, Anatomy and Apothecium V.S
5. Mycorrhizae- Isolation from soil and plant roots
6. Bryophytes- ***Riccia*** - Morphology, anatomy of thallus and sporophyte
7. ***Anthoceros*** - Morphology of gametophyte, anatomy of thallus and sporophyte
   Moss - morphology of gametophyte and sporophyte, V.S of capsule
8. Tissues and types - Apical meristem, Parenchyma, Collenchyma, Sclerenchyma, Xylem and Phloem
9. Preparing free hand sections (T.S) & Staining . Anatomy of root- T.S young dicot root and monocot root
10. Anatomy of stem- T.S of young dicot stem and monocot stem
    Spotters- Commercial wood species of South India –Sandal ,Teak, Rose wood, Mahagony, Jack.
11. Field visit / workshop
12. Practical test

B.Sc SEMESTER – II

G507. 2E PLANT NUTRACEUTICALS

Choice based credit system – **Intradisciplinary** - An elective course which expands the scope of the discipline of study **30 Hours (2 hrs/week)**

Course outcomes:

On completion of this course student will be able to

- understand the benefits of food and nutraceuticals
- understand the effects on human health and potential applications in risk reduction of diseases.

UNIT 1 **15 hrs**

1.1 Phytonutraceuticals: Introduction, importance, classification of nutraceuticals, dietary supplements, fortified foods, functional foods and phytonutraceuticals. Carbohydrates, Protein, amino acids, Fat, vitamins and minerals - Excess and deficiency symptoms, prevention and management, Single Cell proteins- *Spirulina* and Mushroom

1.2 Prebiotics and probiotics : Concept, importance and mode of action

Prebiotics- Use of prebiotics in maintaining the useful microflora, extraction from plant sources - Plant fibres, *Asparagus*, Banana, Chicory root, Onion, garlic.

Probiotics- examples of microflora used as probiotics, *Bifidobacteruim, Lactobacillus*, *Saccharomyces*

Biofortification and nutritional enhancement.

UNIT 2 **15 hrs**

2.1 Nutritional and Anti-nutritional factors: their types and functions. Role of Nutraceuticals in prevention and treatment of diseases. Application of anti-nutritional factors in healthcare and industrial sectors.

2.2 Anti-oxidants: types and functions. Commercial production of anti-oxidants- conventional methods (Soxhlet extraction, maceration, hydro distillation) and non-conventional methods (Ultrasound assisted extraction, Pulsed electric field extraction, Enzyme assisted extraction process). Applications of anti-oxidants.

REFERENCES

1. Kalia, Manoranjan & Sood. 1996. Food Preservation and Processing. First Edition, Kalyani Publishers, India.

2. Tripathi A.D. 2017. Nutraceuticals Food Processing Technology. Bharti Publications, India

3. Pathak Y.V. 2009. Handbook of Nutraceuticals Volume I: Ingredients, Formulations, and Applications. CRC Press.

4. Muredzi P.2013. Food is Medicine - An introduction to Nutraceuticals. LAP publishers

BSc SEMESTER III

G507.3 PTERIDOPHYTES, GYMNOSPERMS, MORPHOLOGY AND EMBRYOLOGY OF ANGIOSPERMS

48 HOURS - 4 HR/ WEEK

Course outcomes:

On Completion of this Course students will be able to

- understand the diversity and classification of Pteridophytes and Gymnosperms
- gain knowledge on the reproductive structures and life cycle of Pteridophytes and Gymnosperms
- know the morphology of plant fossils and process of fossilization
- understand the process of pollination and its applications in plant breeding
- acquire the basic concepts of plant embryology

UNIT 1 PTERIDOPHYTA 12HRS

1.1 General account - Habit and habitat, external features of sporophyte, Anatomy with stelar evolution and examples, classification (Reimer's System, 1954), Salient features of major classes- Psilopsida, Lycopsida, Sphenopsida and Pteropsida.

Reproduction: Vegetative, asexual and sexual reproduction, Types of embryos, alternation of generation, apogamy and apospory with examples

1.2 ***Psilotum***: Morphologyof sporophyte, Asexual Reproduction- Morphology and internal structure of synangium, morphological views of Synangium

Selaginella**:** Morphology of Sporophyte, stem anatomy, Rhizophore - morphological views and anatomy, stem anatomy, Reproduction- structure of male and female cone, heterospory and its significance, Graphical representation of life cycle

1.3 ***Equisetum*** : Morphology of Sporophyte with emphasis on xerophytic feature

Pteris: Morphology of Sporophyte, Anatomy of Rhizome, Reproduction - morphology and anatomy of sporophyll, spore dispersal mechanism, structure of gametophyte and sex organs, graphical representation of life cycle (homosporous life cycle form)

1.4 ***Marsilea*****:** Morphology, anatomy and evolutionary features of sporophyte, anatomy of rhizome**,** Reproduction - sporocarp, anatomy (H.L.S), morphological views

UNIT 2: GYMNOSPERMS **12HRS**

2.1 General account- Habit and habitat, external features of sporophyte, anatomy, Reproduction- Vegetative and sexual reproduction, Classification (Sporne, 1965) - salient features of classes Cycadopsida, Coniferopsida and Gnetopsida with examples. comparative study of gymnosperms with pteridophytes and angiosperms

Cycas

Morphology of Sporophyte, anatomy of leaflet, coralloid roots - morphology and anatomy, Reproduction - morphology and anatomy of male cone and megasporophylls,structure of ovule, graphical representation of alternation of generation

2.2 *Pinus* - Morphology of Sporophyte, Anatomy of needle, Reproduction - Morphology and anatomy of male cone and female cone, morphological nature of ovuliferous scale and structure of ovule

2.3 Gnetum - Morphology of Sporophyte , Anatomy of stem - primary structure, anomalous secondary growth of eccentric type, Reproduction-morphology and anatomy of male cone and female cone, structure of ovule, angiospermic features of *Gnetum*

2.4 Paleobotany - Fossils, process of fossilization, types (compression, impression, Cast, mold, petrifaction, coal balls). Geological time scale. Morphology of Rhynia, Lepidodendron, Cycadeoidea and Medullosa.

UNIT 3 MORPHOLOGY OF ANGIOSPERMS **12HRS**

3.1 Description of a flowering plant: Typical monocot and dicot plant

Leaf : Parts of the Leaf, Typical Monocot and Dicot leaf

Phyllotaxy: Alternate, opposite (decussate and superposed), whorled

Types: Simple and compound leaves with types

Venation: Types of reticulate and parallel venation

Stipules: Free Lateral, Adnate, Interpetiolar, Intrapetiolar Foliaceous, Ochreate and Bud Scales

Leaf Modifications: Leaf Tendrils, Leaf Spines, Scaly Leaf, Phyllode, and Leafy Buds, Pitcher (*Nepenthes),* Bladder (*Utricularia*) and *Drosera*

3.2 Inflorescence: types with reference to a particular family

Racemose: Simple Raceme, Panicle, Spike , Spadix (Arecaceae, Araceae), Corymb (Caesalpiniae), Umbel (Apiaceae), Catkin, Head (Asteraceae), Globose head (Mimosae)

Cymose: Solitary cyme (Malvaceae), Simple Cyme, monochasial cymes (Scorpioid Cyme, Helicoid Cyme), Dichasial and Polychasial cymes

Special types: Cyathium (Euphorbiaceae), Verticillaster (Lamiaceae), and Hypanthodium (Moraceae)

3.3 Flower Morphology – Parts of a flower and variations

Thalamus: Epigyny, Hypogyny and Perigyny conditions

Bracts: Leafy, Scaly, Spathe, Petalloid, Involucure, Epicalyx and Glumes

Calyx: Persistent, Deciduous and Caducous types

Corolla and their Variations: Cruciform, Rosaceous, Papilionaceous, Campanulate, Tubular, Salver shaped, Infundibuliform, Rotate, Bilabiate and Personate types

Aestivation: Valvate, twisted, imbricate types (ascendingly imbricate, quincuntial, vexillary) types

Androecium: Parts of a stamen, Cohesion – Adelphous, syngenesious, synandrous. Adhesion, Didynamous and Tetradynamous types, Staminode

Gynoecium: Parts of a carpel, Number of carpels, simple, compound,syncarpous, apocarpous. Placentation- Marginal, Axile, Parietal, Basal. Pistillode

3.4 Fruits - Parts of a fruit, types with reference to a particular family

Simple Fleshy: Pome, Berry, Drupe, Pepo, Hesperidium

Dry dehiscent: Legume, Follicle, Siliqua and types of Capsules

Dry indehiscent: Caryopsis, Achene and Cypsella , Cremocarp, Regma, Carcerule and Nut

Schizocarpic fruit: Lomentum

Aggregate: Etaerio of follicles and berries

Multiple: Syconus and sorosis

Technical description of one plant each belonging to Polypetalae and Gamopetalae

UNIT 4 PLANT EMBRYOLOGY 12HRS

4.1 Introduction – contributions of Indian scientists.

Structure of anther (T.S), types of pollen grains and microsporogenesis, development of male gametophyte

Structure of ovule (V.S), types of ovules and megasporogenesis, development of female gametophyte

4.2 Pollination: Introduction, types - self and cross pollination, contrivances for self and cross pollination.

Pollination syndromes-Anemophily, Zoophily, Entomophily, Hydrophily, Malacophily and Chiropterophily, Special Mechanism - lever (*Salvia*)

Principles of plant breeding, heterosis and hybrid vigour

4.3 Fertilization: Process and significance of double fertilization - recognition, pollen - stigma interaction, growth of pollen tube, chalazogamy, porogamy, mesogamy

Endosperm: Types and development of cellular, free nuclear and helobial

4.4 Embryo: Structure and development of dicot and monocot embryos

Seed: Parts of dicot and monocot seeds, Endospermous & Non Endospermous seeds

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G507.3P PTERIDOPHYTES, GYMNOSPERMS, MORPHOLOGY AND EMBRYOLOGY OF ANGIOSPERMS

(PRACTICALS OF 3 HR EACH, 1 PRACTICAL PER WEEK)

1. Pteridophytes - ***Psilotum*** - Morphology of sporophyte and T.S. of Synangium
   Selaginella -Morphology of sporophyte, Anatomy of Rhizome, cone W.M. and L.S
2. ***Equisetum***- Morphology of sporophyte. ***Pteris*** - Morphology of sporophyte, anatomy of Rhizome**,** Sporophyll T.S. and Gametophyte
3. ***Marselia*** - Morphology of sporophyte**,** anatomy of rhizome and sporocarp (H.L.S.)
4. Gymnosperms- ***Cycas***: Morphology of sporophyte**,** anatomy of leaflet, Coralloid roots and its anatomy, Male Cone, Microsporophyll and its T.S, Megasoprophylls, Ovule V.S.
5. ***Pinus:*** Morphology of Sporophyte, Anatomy of Needle, Male Cone and its L.S., Pollen Grains W.M, Female Cone, L.S. and Ovule V.S.
6. **Gnetum** - Morphology of sporophyte, Anatomy of Young Stem, Eccentric Secondary Growth, Male Cone and its L. S., Female Cone L.S., ovule V.S.
7. **Leaf -** Stipules- adnate, interpetiolar, foliaceous and ochreate, Modifications-leaf tendrils, leaf spines, phyllode and leafy buds
8. **Inflorescence** - Types: Simple Raceme, Panicle, Spike, Spadix, Corymb, Umbel, Globose Head, Capitulum, Solitary Cyme, Simple Cyme, Monochasial, Dichasial Cymes, Cyathium, Verticellaster and Hypanthodium
9. **Fruits** - Types: Simple Fleshy, Simple Dry Dehiscent and Indehiscent, Aggregate and Composite
10. Technical description of one plant each belonging to Polypetalae and Gamopetalae
11. **Embryology -** Anther- T.S. of Young and Mature anther, Pollen viability test, types of Placentation and Ovules, Parts of dicot and monocot seed, V.S of dicot and monocot embryo, Separation and mounting of embryos of Rice and Gram
12. Practical Test

B.Sc SEMESTER – III

G507.3 E MEDICINAL BOTANY

Choice based credit system – **Interdisciplinary-** An elective course for skill development which enables an exposure to some other discipline/domain

30 Hours (2 hrs/week)

Course outcomes

On completion of this course student will be able to

- understand the concept of plant based medicine
- know the Medico-ethnobotanical sources
- identify local wild edible and medicinal plants

UNIT 1 **15 hrs**

1.1 Medicinal Botany: History and Scope, Importance of Medicinal Plants. Indigenous Medicinal Sciences; Definition and Scope-Ayurveda, Siddha, Unani.

Systematic position & medicinal uses of the following herbs in curing various ailments; Tulsi, Ginger, Fenugreek, Indian Goose berry and Ashoka. Use of natural products to cure certain diseases- Jaundice, cardiac, infertility, diabetics, blood pressure and skin diseases.

1.2 Phytochemistry - active principles and methods of their testing, identification and utilization of the medicinal herbs; *Catharanthus roseus* (cardiotonic), *Withania somnifera* (drugs acting on nervous system), *Clerodendron phlomoides* (anti-rheumatic) and *Centella asiatica* (memory booster). Biological testing of herbal drugs - Phytochemical screening tests for secondary metabolites (alkaloids, flavonoids, steroids, triterpenoids, phenolic compounds)

UNIT 2 **15 hrs**

2.1 Medico-ethnobotanical sources: in India, significance of the following plants in ethno botanical practices (along with their habitat and morphology) *Holigarna ferruginea, Cynodon dactylon, Cymbopogon citratus, Achyranthus aspera, Azadiractha indica, Ocimum sanctum, Vitex negundo, Gloriosa superba, Tribulus terrestris, Pongamia pinnata, Cassia auriculata, Indigofera tinctoria, Mimosa pudica, Phyllanthus amarus, Cyperus rotundus, Aerva lanata.*

Role of ethnobotany in modern medicine with special reference to *Phyllanthus niruri, Rauvolfia sepentina*, *Trichopus zeylanicus*, *Artemisia vulgaris* ,*Withania somnifera*.

2.2 Wild edible plants of the locality : *Aporusa lindleyana*, *Phyllanthus emblica, Syzigium caryophyllatum, Artocarpus hirsutus, Ixora coccinia, Amaranthus viridis, Cassia tora, Colocasia esculenta, Carissa congesta, Garcinia indica.*

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B.Sc SEMESTER IV

G 507.4 PLANT TAXONOMY, ETHNOBOTANY AND ECONOMIC BOTANY

48 HOURS - 4 HR/ WEEK

Course outcomes:
On Completion of this Course students will be able to

- understand the concept of plant systematics and classification
- describe the principles and rules involved in plant systematics and classification
- identify the plants upto the level of a family
- understand the application of this field in floriculture, agriculture and medicine
- practice sustainable use of plant resources

UNIT 1: SYSTEMATICS 12HRS

1.1 Introduction- Importance of systematics

Systems of classification - Artificial, Natural and Phylogenetic

Artificial system: Karl Von Linnaeus - Brief Account

Natural system: Detailed study of Benthem and Hooker's classification

1.2 Phylogenetic system: Brief account of Engler and Prantl's system

Modern Trends in Taxonomy: A brief study of cytotaxonomy, chemotaxonomy and molecular taxonomy

An introduction to APG system of classification

1.3 Plant nomenclature: Introduction to ICBN (International Code of Botanical Nomenclature), Binomial nomenclature with principles and guidelines

Herbaria: Introduction, herbarium techniques (plant collection, processing and preservation), Digital herbaria, Regional Herbaria, National Herbaria and International Herbaria

1.4 Botanical gardens: Significance of National and International Botanical Gardens and Arboretum

Flora: Regional and National Flora with Significance

UNIT 2 POLYPETALAE & GAMOPETALAE **12HRS**

2.1 Study of Selected Families (Bentham and Hooker's System of Classification):

Diagnostic characters with morphological peculiarities (Wherever applicable) and economic importance of the following families

Dicotyledonae – Polypetalae - Annonaceae, Brassicaceae, Malvaceae, Tiliaceae,

2.2 Polypetalae - Rutaceae, Anacardiaceae, Papilionaceae, Caesalpiniaceae, Mimosaceae,

2.3 Polypetalae -Cucurbitaceae, Myrtaceae and Apiaceae

2.4 Gamopetalae: Rubiaceae, Asteraceae, Apocyanaceae, Asclepiadaceae

UNIT 3: GAMOPETALAE (Continued) **12HRS**

Diagnostic characters with morphological peculiarities (wherever applicable) and economic importance of the following families

3.1 Gamopetalae: Convolvulaceae, Solanaceae, Scrophulariaceae, Acanthaceae and Lamiaceae

3.2 Apetalae: Amaranthaceae, Euphorbiaceae and Moraceae

3.3 Monocotyledonae: Liliaceae, Zingiberaceae, Musaceae

3.4 Monocotyledonae: Arecaceae, Orchidaceae and Poaceae

UNIT 4: ETHNOBOTANY AND ECONOMIC BOTANY **12HRS**

4.1 Ethnobotany: Introduction, Scope and its Importance

Bioprospecting: Introduction, a brief note on Indigenous Knowledge Systems, Indigenous people and protected areas, Biopiracy, IPRs and Ownership of Traditional Knowledge, Community Biodiversity Registers.

4.2 Economic Botany: Introduction & Importance

Distribution, Family, Botanical Name, parts used and uses of the following

Cereals and Millets: *Triticum aestivum , Oryza sativa, Zea mays , Eleusine coracana, Sorghum bicolor*.

Pulses: *Vigna sinensis , Cicer arietinum , Pisumsativum, Vigna radiata , Phaseolus mungo, Dolichos biflorus , Phaseolus vulgaris*

Oil yielding plants: *Arachis hypogaea , Cocos nucifera, Helianthus annuus , Brassica nigra, Ricinus communis , Sesamum indicum* . Extraction of Coconut Oil

Sugar Yielding Plants: *Saccharum officinarum, Beta vulgaris, Stevia rebaudiana*. Extraction of sugar from sugarcane

4.3 Spices and Condiments: *Piper nigrum, Syzygium aromaticum, Coriandrum sativum, Zingiber officinale, Curcuma longa, Elettaria cardamomum, Allium cepa, Allium sativum, Capsicum annuum, Cinnamomum verum, Ferula asafoetida*.

Alcohol and Beverages: *Vitis vinifera*, Preparation of Wine.

Coffea arabica, Camellia sinensis, Theobroma cacao, Garcinia mangostina. Extraction of Coffee, Cocoa.

Fiber Yielding Plants*: Gossypium hirsutum , Corchorus capsularis, Cannabis sativa, Musa textilis, Linum uritatissimum, Crotalaria juncea,* Extraction of fibre from Jute, Coir, Coconut

Rubber yielding plant: *Hevea brasiliensis.* Extraction of rubber.

Gums and Resins: *Achrus sapota, Acacia senegal, Anacardium occidentale, Ailanthus triphysa*

4.4 Narcotic/Stimulant Plants: *Cannabis sativa, Papaver somniferum, Nicotiana tobaccum*

Flavouring and Perfumery Products: *Rosa damascena, Vanilla planifolia, Santalum album, Eucalyptus globulus* Extraction of Essential oil.

Medicinal Plants: Distribution, Family, Botanical Name, Parts used and Therapeutic uses of *Anamirta cocculus, Piper longum, Garcinia indica, Plumbago indica, Terminalia chebula, Terminalia arjuna, Cyperus rotundus, Cordia dichotoma, Strychnos nux-vomica.*

Fruit yielding: *Mangifera indica, Musa paradisiaca, Syzigium cumini, Annona squamosa*

Flower yielding - *Dendrobium, Phalanopsis, Jasminum* sp. *Anthurium, Chrysanthemum, Tagetus erectus*

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BSc SEMESTER IV

G507.4 P PLANT TAXONOMY, ETHNOBOTANY AND ECONOMIC BOTANY

(PRACTICALS OF 3HRS EACH, ONE PRACTICAL PER WEEK)

1. Technical Description - *Hibiscus rosa-sinensis* and *Allamanda cathartica*
2. Study of Dicot Families Polypetalae: Malvaceae, Papilionaceae
3. Study of Caesalpiniae, Mimosae
4. Study of Anacardiaceae, Umbelliferae
5. Study of Gamopetalae- Rubiaceae, Asteraceae, Apocynaceae
6. Study of Asclepiadaceae, Convolvulaceae, Solanaceae
7. Study of Scrophulariaceae, Acanthaceae, Lamiaceae
8. Study of Apetalae - Amaranthaceae, Euphorbiaceae
9. Study of Monocot Families **:** Orchidaceae, Musaceae, Arecaceae and Poaceae
10. **Economic Botany:**

    Wine preparation from grapes and estimation of sugar content

    Extraction of Essential oil from plant samples.

    Hair oil preparation- *Hibiscus, Eclipta alba, Phyllanthus emblica*

    Scientific Name, Common Name, Part used and importance of

    Pulses: Cow Pea, Bengal Gram, Pea, Green Gram, Black Gram, Horse Gram and Beans

    Cereals and Millets: Wheat, Maize, Rice, Ragi and Jowar

    Sugar Yielding Plants: Beet Root and Sugarcane

    Oil Yielding Plants: Ground Nut**,** Mustard, Castor, Sesame and Coconut

    Spices and Condiments: Pepper, Clove Coriander, Ginger, Turmeric, Cardamom, Onion, Garlic, Red Chilly, Cinnamon, Cumin and Asafoetida

    Beverages: Coffee, Tea and Cocoa

    Fiber Yielding Plants: Cotton, Jute and Banana

    Plantation Crops: Rubber, Arecanut and Cashew

    Medicinal Plants: Long pepper, Cocum, Plumbago , *Cyperus rotundus*
11. Field Visit and five specimens for Herbaria Preparation
12. Practical Test

B.Sc SEMESTER IV

G507.4E NURSERY MANAGEMENT AND GARDENING

Choice based credit system – **Interdisciplinary-** An elective course which enables an exposure to some other discipline/domain

30 Hours (2 hrs/week)

Course outcomes:

On completion of this course student will be able to

- understand the concept and importance of gardening
- maintain a nursery
- commercialize the knowledge

UNIT 1 **15 Hrs**

1.1 Nursery: Definition, objectives, scope and building up of infrastructure

Planning and seasonal activities - Planting - direct seeding and transplants. Nursery Management and Routine Garden Operations. Different types of gardening- Landscape and home gardening - parks and its components, plant materials and design

1.2 Gardening operations: soil laying, manuring, watering.

Principles of organic farming, Management of pests.

Green house - mist chamber, shade house and glass house for propagation.

UNIT 2 **15 Hrs**

2.1 Propagation methods: Sowing/raising of seeds and seedlings, transplanting of seedlings. Air-layering, cutting, selection of cutting , propagule collecting season, treatment of cutting , rooting medium and planting of cuttings, Hardening of plants.

2.2 Ornamental Plants with examples: Flowering annuals; herbaceous, perennials, Divine vines, Shade and ornamental trees, Ornamental bulbous and foliage plants, Cacti and succulents, Ornamental palms, Medicinal, Aromatic plants and Hydrophytes

Cultivation of plants in pots, Indoor gardening, Bonsai.

Cultivation of Important flowers (Anthuriums, Orchids, Marigold, Jasmine)

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1. Ratha Krishnan, P., Kalia R.K., Tewari J.C. and Roy M.M., 2014. Plant Nursery Management: Principles and Practices. Central Arid Zone Research Institute, Jodhpur.
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3. Uberoi M. 2002. The Penguin Book of Gardening in India. Penguin random house publishers, New Delhi
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B.Sc SEMESTER V

G 507.5a PLANT ECOLOGY & SUSTAINABLE DEVELOPMENT

42 HOURS - 3 HR/ WEEK

Course outcomes:

On Completion of this Course students will be able to

- learn various types of ecosystems and its significance in biodiversity conservation
- understand ecological concepts like succession and plant adaptations
- learn the practical application of research methodologies in ecology with reference to community studies
- understand the concept of sustainability
- understand the limitations of available natural resources and the need to sustain them
- evaluate sustainable management related to local and global issues
- get knowledge on the recent issues associated with environment

UNIT 1: PLANT ECOLOGY AND VEGETATION STUDIES 14HRS

1.1 Plant Ecology: Introduction to Ecology and importance, Autecology & Synecology

Ecosystems - Concepts, functioning, components and productivity

Energy flow in an ecosystem, food chain, food web and ecological pyramids -Types in detail with reference to various ecosystems

1.2 Major Ecosystems & Diversity: A detailed study of the types of Ecosystems- Terrestrial, Aquatic and Urban Ecosystems

Genetic Diversity, Species Diversity and Ecosystem Diversity. Alpha diversity, beta diversity and gamma diversity.

1.3 Vegetation Studies: Sampling methods, species density, abundance and richness. Basal area and relative dominance

Ecological studies using Diversty indices, Importance Value Index – Relative Dominance, Relative frequency, Relative density.

1.4 Remote sensing: Tools and techniques in remote sensing – GPS, GIS.

Applications of remote sensing in vegetation studies – weather forecasting, A brief account on NDVI –Normalised difference vegetation index

UNIT 2: ECOLOGICAL GROUPS, SUCCESSION AND ECOLOGICAL ADAPTATIONS **14HRS**

2.1 Ecological Groups: Introduction and Classification

Hydrophytes: Classification, morphological, anatomical, physiological characters and adaptations in:

1. *Lemna* 2.*Pistia* 3.*Eichhornia* 4.*Utricularia* 5.*Potamogeton* 6.*Hydrilla*

7. *Ceratophyllum* 8. *Vallisnaria* 9. *Nymphaea* 10. *Jussiaea* 11. *Sagittaria* 12.*Typha*

2.2 Xerophytes: Classification, morphological, anatomical, physiological characters and adaptations in

1. *Aloe* 2. *Agave* 3. *Opuntia* 4. *Euphorbia* 5. *Muehlenbeckia* 6. *Asparagus* 7. *Ruscus*

8. *Calotropis* 9. *Acacia* 10. *Capparis* 11. *Zizypus* 12. *Casuarina* 13. *Nerium*

14. *Argemone*

Epiphytes: Classification, morphological, anatomical, physiological characters and adaptations in

1.*Vanda* 2. *Dischidia* 3. *Bulbophyllum* 4. *Ficus*

2.3 Halophytes: Classification, morphological, anatomical, physiological characters and adaptations in

1. *Avicinnia* 2. *Rhizophora.*

Mesophytes: Morphological, anatomical, physiological characters in Dicots and Monocots- Root, stem and leaf

2.4 Ecological Succession- Concept and importance

Process in succession: 1.Nudation 2.Migration 3.Ecesis 4.Aggregation 5.Invasion 6.Community Relationships 7.Competition, 8.Reaction 9.Stabilization

Hydrosere: 1.Plankton Stage 2.Submerged Stage 3.Floating Stage 4.Reed Swamp Stage 5.Marsh Meadow Stage 6.Woodland Stage 7.Climax Vegetation

Xerosere: 1.Crustose Lichen Stage, 2.Foliose Lichen Stage 3.Moss Stage 4.Herbaceous Stage 5.Shrub Stage 6.Climax Vegetation

UNIT 3: SUSTAINABLE DEVELOPMENT **14HRS**

3.1 Sustainable Development: Concept & importance, Urban problems related to energy, Energy problems in India and solution, New source of energy-solar, wind, water, geothermal, biomass and nuclear.

Natural Resources and their Conservation

Renewable and non renewable resources in detail.

3.2 Diversity Conservation: India as a megadiversity Nation, Hotspots of biodiversity, Threats to biodiversity, Endangered, Endemic**,** & RET plant species of India, Conservation methods in detail - *in situ* and *ex situ* conservation.

3.3 Water Conservation: Rain Water Harvesting, Watershed Management, Watershed Conservation Practices, Comparison of traditional with modern methods, a brief note on water recycling- Desalination method, Importance of Forests as major water tables. Major rivers in India, Importance of Rivers, River diversion- benefits and problems

3.4 Sustainable Waste Management: Importance, Sustainable Waste Management of Solid Waste, Sewage, E-Waste, Agricultural Waste, Radioactive Waste, Treatment and Disposal, Recycling and composting, Waste Water Treatment, Waste land management, Energy plantation

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B.Sc SEMESTER V
G507.5b CYTO GENETICS AND MOLECULAR BIOLOGY

42 HRS - 3 HR / WEEK

Course outcomes:
On Completion of this Course students will be able to

- understand the concept of chromosomal organization, biomolecules (protein and nucleic acid)
- acquire knowledge of the genes inhabiting the cellular world of life that are engaged in metabolic processes.
- understand the concepts of cell division and cell cycles .
- gain knowledge on principles of genetics
- to understand the natural genetic variation in plants and to know how diverse factors contribute to the expression of genotypic and phenotypic variation.
- understand the effect of different types of mutation on genotypic and phenotypic expression
- understand the concept of plant sex determination and gene mutation
- to widen the knowledge on the role of polyploidy in plant breeding which could be employed in diverse fields of basic and applied research.

UNIT 1 CHROMOSOMES AND BIOMOLECULES: 14HRS

1.1 Chromosomes and Cell division: Introduction, Chromatin Organisation- Nucleosomes, Solenoids and metaphase fibre, Parts of the typical Metaphase Chromosome, Cell division, cell cycle, stages of mitosis and meiosis

1.2 Nucleic Acids: Introduction, discovery, chemical composition, structure of DNA- Watson and Crick model, brief note on types of DNA, organelle DNA (mitochondrial DNA in *Brassica* sp. and Yeast and plastid DNA in *Mirabilis jalapa*) and functions, RNA types and functions.

Experimental evidences to prove DNA as genetic material- Griffith, Avery *et.al*., Hershey and Chase experiments

DNA-replication: Experimental evidence in brief- Meselson and Stahl experiment, steps involved in semi-conservative method of replication

1.3 Genetic code: Concept of Gene- Cistron, Muton and Recon. Discovery of genetic code characteristic features with examples

Protein Synthesis: Process and mechanism of Transcription and Translation (process of initiation, elongation and termination)

1.4 Gene Regulation: Gene regulation in prokaryotes, Lac operon concept, gene regulation in eukaryotes, a brief note on m- RNA processing, gene silencing, RNA editing and transposons. A brief note on mitochondrial inheritance & chloroplast inheritance.

UNIT 2 GENETICS **14HRS**

2.1 Mendelism: Mendel and his work, Monohybrid and law of Segregation, Dihybrid cross and Law of Independent assortment. Back Cross and Test cross.

2.2 Deviations from Mendelism: Incomplete dominance with plant example, multiple allelism- self sterility alleles in plants with examples

Interaction of genes: Introduction, types, inheritance pattern of complementary, supplementary, epistatic, duplicate genes with a plant example for each. 9:7 (Complementary - Flower Colour in Sweet Peas), 9:3:4 (Supplementary – Grain colour in Sorghum)

2.3 Interaction of genes: 12:3:1 (Dominent epistasis – Fruit Colour in *Cucurbita pepo*), 15:1 (Duplicate Dominent epistasis - Fruit shape in *Capsella bursa – pastoris*), 9:6:1 (polygenic -Aleurone colour in maize).

2.4 Linkage: Types, Complete and incomplete, linkage in plants (maiz*e*), significance of linkage

Crossing Over: Types, cytological basis of crossing over in plants, significance

UNIT 3: SEX DETERMINATION & MUTATIONS **14HRS**

3.1 Sex Determination: Note on chromosomal mechanisms of sex determination, XX-XY method in *Melandrium album*. Gene controlled mechanism in plants (Maize, Papaya, *Luffa* and *Asparagus*)

3.2 Genomic Mutations (Numerical Variations)

Aneuploidy: Trisomy in *Datura* and Nullisomy in Wheat

Haploidy in plants: Occurrence, Cytology and Significance

Polyploidy: Origin of Auto and Allopolyploidy

Significance - Role of Auto and Allopolyploidy in Plant breeding, Speciation and Evolution with examples (Production/origin of *Raphanobrassica*, Tetraploid and Hexaploid varieties of Wheat, Tobacco, Cotton and *Triticale*)

3.3 Chromosomal aberrations (structural variations): Types, Cytology and Significance of Deletions, Duplications, Inversions and Translocations in Plants

3.4 Point / gene mutation: Definition of Dominant & Recessive, Somatic & Germinal, Lethal mutations, A Note on - Spontaneous & Induced mutations, Base pair and frame shift mutations, Brief note on Mutagens- Physical and Chemical.

Proteomics and Genomics: An introduction to Proteomics and Genomics with a brief note on plant genome

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G507.5P PLANT ECOLOGY & SUSTAINABLE DEVELOPMENT CYTOGENETICS & MOLECULAR BIOLOGY

(PRACTICALS BASED ON G507.5a AND G507.5b, ONE PRACTICAL OF 4 HRS PER WEEK)

1. **Major Experiments and Spotters**

   Study of Ecological Group: Hydrophytes -Morphology of free floating forms: *Pistia, Eichhornia, Salvinia, Lemna, Azolla.*

   Submerged floating: *Hydrilla, Utricularia, Ceratophyllum*

   Rooted submerged: *Vallisneria*

   Rooted with floating leaves: *Nymphaea, Marsilea*

   Emergent: *Limnophylla heterophylla, Typha, Jussiaea, Sagittaria, Ranunculus*

   Study of anatomy of hydrophytes: T. S of *Hydrilla* Stem, *Nymphaea* petiole, *Jussiaea* Stem, *Vallisneria* Leaf

2. **Major Experiments and Spotters**

   Study of Ecological Group: Xerophytes - Morphological Characters - *Aloe, Agave, Opuntia, Euphorbia, Asparagus, Ruscus, Calatropis, Acacia, Capparis, Zizypus, Muehlenbeckia, Casuarina, Nerium, Argemone*

   Study of anatomy of xerophytes: T.S of *Nerium* leaf, T.S of *Casuarina* phylloclade, T.S of *Acacia* phyllode, T.S of *Muehlenbeckia*, T.S of *Asparagus* cladode

3. **Major Experiments and Spotters**

   Study of Ecological Group: Epiphytes- Morphology of *Vanda, Bulbophyllum, Drynaria*, **Anatomy** of *Vanda* Epiphytic Root

4. **Major Experiments and Spotters**

   Study of Ecological Group: Halophytes

   Morphology of *Spinifex, Avicennia* pneumatophore, *Rhizophora* vivipary

   Anatomy of A*vicennia* Pneumatophore

5. **Minor Experiment**

   Study of pond ecosystem: Study of all the Biotic components - producers, consumers, primary, secondary, tertiary and decomposers

   Minor Experiment (Problems)

   Ecological studies using Simpsons Index, Importance Value Index – Relative Abundance, Relative frequency, Relative density

6. **Major Experiment**

   Isolation of DNA from Coconut Endosperm / Tomato pulp/ Onion Bulb

7. **Major Experiment**

   Isolation of DNA from leaves

   Agarose gel Electrophoresis-Preparation of gel & loading of the sample (dye can be given)

8. **Major Experiment**

   Separation of eye pigments in ***Drosophil*a**, and determination of Rf value by Circular paper chromatography method.

   Spotters

   Karyotype and Trisomy in ***Datura*:** morphological variations in the shape of the capsules, Linkage map, Reciprocal translocation heterozygotes-segregation patterns and gametes formation

9. **Minor Experiment** - Cell division – Mitotic stages in Onion Root Tip by Squash method

   Minor Experiment - To Solve Genetic Problems

   Mendelism - Mono and dihybrid crosses with test crosses, Incomplete dominance- mono and dihybrid crosses

10. **Minor Experiment:** To Solve Genetic Problems

    Interaction of genes - complementary, supplementary, epistatic and duplicate genes.

    Minor Experiment: To solve genetic problems

    Multiple alleles- self sterility alleles in plants

11. **Visit to Industries/Research Institutions**

12. Practical test

B.Sc SEMESTER VI

G507.6a PLANT PHYSIOLOGY

42 HOURS- 3 HRS / WEEK

Course outcomes:
On Completion of this Course students will be able to

- learn the underlying principles of various physiological processes like Ascent of sap, transpiration, photosynthesis, translocation and respiration in plants
- understand the mechanism involved in these physiological processes
- know the various plant growth substances and their physiological effects
- understand the role of mineral nutrients in plants
- understand the concepts like vernalization and photoperiodism, and their practical applications in agriculture
- acquire the information on plant signalling and communication in plants

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UNIT 1: PLANT WATER RELATIONS 14 HRS

1.1 Concept of Imbibition, Diffusion and Osmosis: Osmotic Pressure (O.P), significance of osmosis in plants, plasmolysis and its significance, diffusion pressure deficit (D.P.D), turgor pressure (T.P), plant cell as an osmotic system, relationship between O.P., T.P., D.P.D., Water potential and osmotic relations of plant cells,(relationship between ψ_m, ψs, ψp)

1.2 Absorption of Water: Types of Soil Water, Mechanism of water absorption: 1) active absorption of water (Osmotic and Non osmotic absorption) and Passive absorption of water, External factors affecting water absorption, significance.

Ascent of Sap

Path of ascent of sap, Mechanism of ascent of sap, Physical force theory - Transpiration pull (cohesion tension theory), Merits and Demerits.

1.3 Transpiration and Guttation: Transpiration, kinds of transpiration, Mechansim of transpiration - starch sugar inter conversion theory, proton exchange pump theory, significance of transpiration, advantages of transpiration transpiration as a necessary evil, factors affecting thr rate of transpiration, plant antitranspirants, Structure of hydathode, differences between transpiration and guttation

1.4 Translocation of Organic Solutes: Direction of translocation, path of translocation of organic solute, Mechanism of translocation through phloem – Munch's (mass flow) hypothesis, phloem loading and unloading

Mineral Nutrition

Essential and non essential elements in plants, general functions of essential elements in plants, specific roles and deficiency symptoms of the following mineral elements in plants Major elements: Nitrogen, Phosphorous and Magnesium

Minor elements: Iron, Manganese and Zinc, Soiless Growth - Hydroponics & Aeroponics

UNIT 2: BIOENERGETICS 14 HRS

2.1 Photosynthesis: History, Ultrastructure of chloroplast, photosynthetic pigments, absorption spectrum and action spectrum, quantum requirement and quantum yield, red drop and Emmerson's enhancement effect, PS I & PS II.

2.2 Mechanism of Photosynthesis : Light reaction/ primary photochemical reaction - Cyclic and Non Cyclic, Chemiosmotic mechanism, Dark reaction/ Carbon fixation cycle / Calvin cycle, Factors affecting Photosynthesis, Blackman's law of limiting factors, Applications of Radioisotope C^{14}

2.3 C4 / dicarboxylic acid pathway/ Hatch-slack pathway, differences between C3 and C4 plants, Photorespiration and gylcolate metabolism (C2 cycle), Crassulacean Acid Metabloism (CAM cycle)

2.4 Respiration: Aerobic and Anaerobic Respiration, Ultrastructure of Mitochondrion, Mechanism of respiration - Glycolysis, Kreb's Cycle, Terminal oxidation (Oxidative phosphorylation)., Fermentation - Alcoholic and Acidic, significance. Respiratory quotient, Factors affecting respiration, Pasteur's effect

UNIT 3: PLANT GROWTH AND HORMONES 14 HRS

3.1 Growth: Definition, regions of growth, growth curve, measurement of growth, direct method, horizontal microscope method, Arc auxanometer, Pfefer's auxanometer

Hormones: Natural and Synthetic types

Auxins: Discovery, Chemical Nature, Natural Auxins, Synthetic Auxins, Physiological effects of Auxins

3.2 Gibberellins: Discovery, Chemical Nature, Physiological Effects of Gibberellins

Kinetin and Cytokinins: Discovery, Chemical Nature, Zeatin, Physiological effects of Kinetin/Cytokinin

Ethylene: Discovery, Physiological Effects of Ethylene

A brief note on Plant signalling- Pathway of Ethylene formation, brief note on antisense RNA technology

3.3 Abscissic Acid: Discovery, Chemical Nautre, Physiological effects of Abscissic Acid

Photoperiodism: Short day Plants, Long day Plants, Day neutral Plants, Photoperiodic Induction, Phytochromes,Vernalisation & its Practical Applications

3.4 Germination and dormancy of seeds and buds: Physiological and Biochemical changes accompanying seed germination. Dormancy of seeds, factors causing dormancy of seeds, artificial methods of breaking seed dormancy, Quiscent seeds, longevity of seeds, orthodox and recalcitrant seeds

Plant movements: Broad classification of plant movements, Tropic, Nastic, and Tactic Movements in detail.

Tropic movements -- Geotropic, phototropic, thigmotropic ,hydrotropic, chemotropic, thermotropic, and aerotropic movements.

Nastic movements –Nyctinastic, seismonastic, and thigmonastic movements.

Tactic movements – Phototactic, chemotactic, and thermotactic movements.

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B.Sc. SEMESTER VI

G507.6b PLANT BIOTECHNOLOGY, PHYTOCHEMISTRY AND PHARMACOGNOSY

42 HOURS - 3 HR / WEEK

Course outcomes:
On Completion of this Course students will be able to

- learn the concepts and fundamental aspects pertaining to plant biotechnology, phytochemistry, pharmacognosy
- understand the concept of genetically modified plants and their relevance to economy
- know the principle involved in cultivation of medicinal plants by organic farming, plant tissue culture and to realize the eco friendly potential application of biotechnological processes in pharmaceuticals ,food industry, agriculture and its role in bioremediation.
- enhance their analytical skills in research and know the lab safety measures.
- acquire knowledge with regard to commercializing the primary and secondary metabolites as natural medicinal drugs.

UNIT 1: PLANT BIOTECHNOLOGY **14 HRS**

1.1 Gene Cloning- Tools, Steps and applications-a brief note on transgenic plants (GMOs-golden rice and Bt –cotton), Advantages and disadvantages of GMOs. Plantibodies.

1.2 Plant Tissue Culture : Concept of totipotency**,** cell differentiation, callus and organogenesis

Tissue Culture Media

Laboratory organisation, note on biohazards and biosafety

Physical factors and nutrient requirements, media, tools and techniques - instruments, explant sterilization and transfer**.**

1.3 Micropropagation : Types of micro propagation, meristem culture, anther culture, pollen culture, cell and protoplast culture.

1.4 Application of tissue culture- germplasm conservation, somaclonal variations, agriculture, molecular farming from transgenic plants, Synthetic seeds.

UNIT 2: PHYTOCHEMISTRY **14HRS**

2.1 Metabolism: Definition, types (primary & secondary)

Primary metabolism: Primary metabolites - types of carbohydrates, proteins and lipids with crude drugs (source, properties and therapeutic uses). Metabolic pathways -citric acid and pentose path ways with significance

2.2 Secondary Metabolism: Shikimic acid and Mevalonic acid pathways with significance

2.3 Secondary Metabolites: Definition, source, physicochemical properties and therapeutic properties of the following types of secondary metabolites

Alkaloids - *Rauwolfia serpentina, Vinca rosea*

Tannins - *Terminalia* sp., *Phyllanthus emblica*

Glycosides - *Cassia angustifolia, Digitalis purpurea*

Terpenoides - *Myristica fragrans, Eugenia caryophyllata*

2.4 Secondary Metabolites: Definition, source, physicochemical properties and therapeutic properties of the following types of secondary metabolites

Phenolics - *Coffea* sp., *Solanum* sp.

Flavanoides - *Citrus* sp., *Camellia sinensis*

Steroids - *Spinacia oleracea, Trigonella foenum- graecum*

Resins - *Ferula asafoetida, Commiphora wightii*

UNIT 3: PHARMACOGNOSY **14 HRS**

3.1 Pharmacognosy: History, scope, Branches of Pharmacognosy, Alternative systems of Indian Medicine- Ayurveda, Unani, Siddha, Homeopathy

Crude Drugs- Introduction, types, Organised and Unorganised

3.2 Cultivation: Methods and factors affecting cultivation of medicinal plants

Production of QPM (Quality planting Material), good nursery practices and importance of QPM in Cultivation

Cultivation of RET plants, harvesting practices and post harvest technology – optimum phytochemical assessment, value addition.

3.3 Drug evaluation protocol: Crude drug evaluation of following aspects with suitable examples-morphological, anatomical, organoleptic aspects and active components (phytochemicals) of root, stem, leaf, seed and flower drugs

3.4 Isolation & Quantification Methods: Principle, Procedure and application of Soxhlet, TLC and Spectroscopy.

Drug adulteration

Types of adulterants and substitutes, methods of detection in *Saraca indica* and *Rauwolfia serpentina.*

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G 507.6P PLANT PHYSIOLOGY, PLANT BIOTECHNOLOGY, PHYTOCHEMISTRY AND PHARMACOGNOSY

PART I - REGULAR PRACTICALS **2HRS/WEEK** **50 MARKS**

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1. **Major experiment**: Experiment to measure the osmotic pressure of cell sap by plasmolytic method using *Rhoeo /Tradescantia* leaves

   Major experiment: Experiment to show the relation between absorption and transpiration.

   Major experiment: Ganong's potometer experiment to determine the rate of transpiration under different environmental conditions

   Spotters: Thistle funnel experiment to demonstrate endosmosis
   Experiment to demonstrate the suction due to transpiration
2. **Major experiment:** Extraction and separation of photosynthetic pigments by paper chromatographic method and estimation of chlorophylls.

   Major experiment: Ganong's respirometer experiment to determine the amount of oxygen absorbed and carbon dioxide liberated during aerobic respiration & determination of Rf value

   Spotters: Garreau's experiment to demonstrate the unequal rate of transpiration

   Ganong's colored light screen experiment to demonstrate the effect of different wavelength of lights on rate of photosynthesis
3. **Spotters:** Instruments microtome, Camera Lucida

   Spotters: Tissue Culture - Culture Media, Sterilization Techniques, Explants, Transfer of Explants, Seed Germination on Agar medium
4. **Spotters :** Root Drugs: Rauwolfia , Liquorice

   Stem Drugs - Ginger, Kurchi, Ephedra
   Fruit Drugs - Cumin, Cardamom
   Flower Drugs – Clove
   Seed Drugs - Nux Vomica
   Ergastic Substances: Permanent Slides of Food Reserves and Crystals
5. **Major experiment :** Anatomy of Crude Leaf Drugs: Datura, Vinca
6. Practical Test

G 507.6P PLANT PHYSIOLOGY, PLANT BIOTECHNOLOGY, PHYTOCHEMISTRY AND PHARMACOGNOSY

PART II - ADDITIONAL PRACTICALS **2HRS/WEEK** **50 MARKS**

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1. **Major experiment :** Experiment to show evolution of O_2 under different environmental conditions

   Major experiment : Qualitative analysis of carbohydrates, proteins, cellulose, oil & lignin in the given plant samples
2. **Minor experiment :** Experiment to show the porosity in different types of soil samples and determination of pH of the samples

   Minor experiment: Synthetic seed preparation

   Major Experiment: Soxhlet extraction
3. **Major experiment :** Micrometry : Calibration Under Low power and High power, measurment of any one Sample (any cell)

   Minor Experiment: Study of Stomatal types in leaf samples. Datura, Vasaka, Vinca and Senna
4. **Major Experiment:** Anatomy of crude leaf drugs : Vasaka, Senna
5. **Major Experiment:** Phytochemical Analysis : TLC of any crude Extract **.**

   Major Experiment: Qualitative analysis of phytochemicals.
6. Practical test

B.Sc. SEMESTER VI

PART I: COMPULSORY SET OF EXPERIMENTS

PART II: PROJECT/ ADDITIONAL PRACTICAL EXPERIMENTS

NOTE:

- All Students will have regular practicals (Part I).
- Every student shall have 1 project (Part II) in any one of the discipline for 50 Marks.
- Project topics can be given to the students in the beginning of V semester.
- Students who do not opt for project (Part II) in a particular subject, along with regular practicals (Part I) will have additional experiments (Part II) for 50 marks.

ALOTTMENT OF MARKS FOR PROJECT

Report=30 Marks

Viva= 10 Marks

Continuous Internal Assessment=10 Marks

QUESTION PAPER PATTERN: [THEORY CORE PAPER]

[SCHEME TO BE FOLLOWED FOR ALL SEMESTERS]

Time: 3HRS **Max Marks: 100**

Part - A

1) Answer **Any Ten** of the following 10X2 =20
(Ten to be answered out of Twelve)

Part – B

2) Answer **Any Six** of The following 6X5=30
[Six to be answered out of Eight (I-IV Semester) or Nine (V and VI Semester)]

Part-C

3) Answer **any Five** of the following 5X10=50
[Five to be answered out of Eight (I-IV Semester) or Nine (V and VI Semester)]

Question Paper will have Three Parts –**A, B, C**

Part A- Twelve Questions from all the units with equal weightage

Part B- Eight /Nine Questions from all the units with equal weightage

Part C- Eight /Nine questions from all the units with equal weightage

QUESTION PAPER PATTERN: [THEORY ELECTIVE PAPER]

Time: 2 HRS **Max Marks: 50**

Part - A

1) Answer **Any Five** of the following 5X2 =10
(Five to be answered out of Six)

Part – B

2) Answer **Any Four** of the following 4X5=20
(Four to be answered out of Six)

Part-C

3) Answer **any Two** of the following 2X10=20
(Two to be answered out of Four)

Question Paper will have Three Parts –**A, B, C**

Part A- Six Questions from two units with equal weightage

Part B- Six Questions from two units with equal weightage

Part C- Four questions from two units with equal weightage

QUESTION PAPER PATTERN: [PRACTICALS]

G507.1 P VIRUS, BACTERIA & ALGAE

Time: 3HRS **Max Marks: 40**

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1. Identify, sketch & lable Specimen **A.** Leave the preparation for inspection. 5X1=5
   (Preparation= 2, Labled Sketch= 1, Identification= ½ ,Classification=½, Features-1)
2. Identify **B** and **C** With Labelled sketch and Reasons 3+3=6
   (Labeled Sketch = 1, Classification = ½, Identification ½ , Reasons = 1)
3. Write Critical Notes on **D** and **E** 3+3=6
   (Identification with classification=1, Critical notes=2)
4. Sketch, label and identify with reasons **F,G,H, I** and **J** 3X5=15
   (Labeled sketch= 1, identification= ½, reasons=1 ½)
5. Submission of four Specimens and Field Notes 2+1
6. Record 5

Note to the Examiners

1. Specimen **A** from algae (microscopic forms)
2. Specimen **B** and **C** - one from cyanobacteria and one from algae
3. Critical notes **D** and **E** - macroscopic specimens from algae/viral diseases/ bacterial diseases/ mycoplasmal diseases
4. Permanent slides **F**, **G**, **H**, **I** and **J** – one from bacteria/one from cyanobacteria / others are algae
5. Record/specimen valuation by internal examiner based on continuous assessment

QUESTION PAPER PATTERN: [PRACTICALS]

G507.2P FUNGI, PLANT PATHOLOGY ,BRYOPHYTES, AND PLANT ANATOMY

MAX MARKS: 40 **TIME: 3 HRS**

1. Prepare a Temporary mount of material **A.** Identify and leave the preparation for inspection. **06**
   (Preparation-2, labelled sketch -3, identification -1)
2. Prepare a Temporary mount of material **B.** Identify and leave the preparation for inspection. **06**
   (Preparation-2, identification-1, labelled sketch-3)
3. Critically comment on **C,D, E and F** **4x3=12**
   (Identification= 0½, reasons=2½)
4. Identify the given slides **G, H and I** **3x3=9**
   (Identification=½, labelled sketch=1½, reasons=1)
5. Record **07**

NOTE TO THE EXAMINERS

1. Specimen **A** - Bryophyte / Macrofungus/ Rust stage
2. Specimen **B** - Dicot/ Monocot Root/ Dicot/ Monocot Stem
3. Specimens **C, D**, **E**, **F** - one specimen from each group (Lichens/ Plant diseases/ Bryophyte/ Fungi) Specimens OR Photographs
4. Permanent Slides - **G**, **H** and **I** – one slide from each group (histology, fungi/lichen and bryophytes)
5. Record valuation by internal examiner based on continuous assessment

QUESTION PAPER PATTERN: [PRACTICALS]

G 507.3P PTERIDOPHYTES, GYMNOSPERMS, MORPHOLOGY AND EMBRYOLOGY OF ANGIOSPERMS

MAX MARKS: 40 **TIME: 3 HR**

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1. Identify Material **A** and **B**. Leave the preparation for inspection **6X2=12**
   (Preparation-3, Labelled sketch-2, Identification with classification-1)
2. Write Critical Comments on **C, D, E** and **F** **3X4=12**
   (Identification- 0½, Reasons-2½)
3. Identify the given Slides **G, H** and **I**. **3X3=9**
   (Identification-½, Labelled sketch-1½, Reasons-1)
4. Record **07**

Note to the Examiners

1. Specimen **A** - Pteridophyte
2. Specimen **B** - Gymnosperm
3. Specimen **C**, **D**, **E**, **F** - Pteridophyte/Gymnosperm/ Two from Morphology of Angiosperms
4. Specimen **G**, **H**, **I** - Slides (one each from Embryology, Pteridophyte and Gymnosperm)
5. Record valuation by internal examiner based on continuous assessment

QUESTION PAPER PATTERN: [PRACTICALS]

G507.4P PLANT TAXONOMY, ETHNOBOTANY AND ECONOMIC BOTANY

TIME: 3HRS **MAX MARKS: 40**

1.	Derive Systematically and assign the Plants **A, B** And **C.** To their respective families giving salient features (Derivation-01, Family name-01, Salient features -02)	**4X3=12**
2.	Describe the Plants **D** in Technical terms	**03**
3.	Write The Floral diagram and floral formula of **E** (Floral Diagram-02, Floral Formula=01)	**03**
4.	Write the Economic importance of **F, G, H, I, J** and **K** (Scientific Name -½, family ½, part used with uses-1)	**6X2=12**
5.	Class Records	**05**
	Herbarium	**05**

NOTE TO THE EXAMINERS

1. Specimen **A**, **B** and **C**- one each from Polypetalae, Gamopetalae and Apetalae
2. Specimen **D** - Polypetalae or Gamopetalae
3. Specimen **E**- Plant with large dicot flower or large flower buds to be given
4. Specimen **F,G, H, I, J** and **K –**one specimen from each category of Economic botany
5. Record/herbarium valuation by internal examiner based on continuous assessment

QUESTION PAPER PATTERN: [PRACTICALS]

G507.5P PLANT ECOLOGY & SUSTAINABLE DEVELOPMENT, CYTOGENETICS & MOLECULAR BIOLOGY

TIME: 4HRS **MAX MARKS: 80**

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1. Major Experiment A (Plant Ecology) **12x1=12**

Prepare a temporary stained section of the given specimen and leave it for inspection

(Preparation -4, sketch & label-4, identification of the group with ecological features -4)

2. Minor Experiment B (Plant Ecology) **6x1=6**

Identify and comment on the components of the given ecosystem

(Description of ecosystem-2, identification &comment on the components -4)

Or

Solve ecological Problem on Simpsons Index / Importance Value Index – Relative Abundance, Relative frequency, Relative density

(Derivation- 5, Answer -1)

3. Major experiment C (Cytogenetics **&** Molecular biology) **12x1=12**

(Requirements-1, procedure-4, setting and performing-3, result-2, principle involved-2)

4. Solve the given genetic problem D **6x1=6**

(Derivation- 5, Answer -1)

5. Identify and comment on the spotters/ slides **E, F, G, H, I**, &**J** **4x6=24**

(Identification-1, comment-3)

6. Class records. **10x2=20**

NOTE TO THE EXAMINERS

1. One major experiment from Plant Ecology (by lots)
2. One major experiment from Cytogenetics **&** Molecular biology (by lots)
3. Spotters: Three from Plant Ecology and three from Cytogenetics **&** Molecular biology (One stage from mitosis to be included)
4. Record valuation by internal examiner (based on continuous assessment)

QUESTION PAPER PATTERN: [PRACTICALS]

G507.6P PLANT PHYSIOLOGY, PLANT BIOTECHNOLOGY, PHYTOCHEMISTRY AND PHARMACOGNOSY

Time: 2Hrs **PART I** **Max Marks: 40**

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1. **Major Experiment A**

   Plant Physiology - Perform the given experiment and demonstrate the results. Leave the setup for inspection (Setting and demonstration-3, Procedure-3, Result-2 Inference and Principle-2)

   OR **1X10=10**

   Pharmacognosy - Prepare a temporary stained section of the given specimen and leave it for inspection (Preparation -3, Identification- Biological Source, Scientific Name, Family- 2, Identifying anatomical features- 3 ,Compounds -1and Therapeutic uses-1)

2. **Identify and comment on the Spotters- B,C,D & E** **4X5 =20**

   (Identification-1, Comment-4)

3. **Class records**. **10**

NOTE TO THE EXAMINERS

1. One major experiment from Plant Physiology/ Pharmacognosy (by lots)
2. Spotters: Two from Plant Physiology and two from Pharmacognosy/ Plant Biotechnology
3. Record valuation by internal examiner (based on continuous assessment)

QUESTION PAPER PATTERN: [PRACTICALS]

G507.6P PLANT PHYSIOLOGY, PLANT BIOTECHNOLOGY, PHYTOCHEMISTRY AND PHARMACOGNOSY

Time: 2Hrs **PART II** **Max Marks: 40**

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1. **Major Experiment A**

   Plant Physiology - Perform the given experiment and demonstrate the results. Leave the setup for inspection (Requirements -2, Setting and demonstration-3, Procedure-4, Result-3, Inference and Principle-3, Diagram -3.) **[** Chemical test : Procedure-8, Setting and demonstration-8, result-2]

   OR **1X18=18**

   Pharmacognosy - Perform the given experiment and demonstrate the results (Preparation -4, Identification- Biological Source, Scientific Name, Family- 2, Identifying anatomical features- 5, Compounds -2, Diagram -3, and Therapeutic uses-2)

2. **Minor Experiment B (Pharmacognosy / Plant Biotechnology)** **1X12 =12**

   Perform the given experiment and demonstrate the results. Leave the set up for inspection **(**Performance -4, Procedure -4, Result-2, Principle/ diagram -2).

3. **Class records**. **10**

NOTE TO THE EXAMINERS

1. One major experiment from Plant Physiology/ Pharmacognosy (by lots)
2. One minor experiment from Pharmacognosy/ Plant Biotechnology (by lots)
3. Record valuation by internal examiner (based on continuous assessment)