



**ST ALOYSIUS COLLEGE (AUTONOMOUS)
MANGALURU**

**Re-accredited by NAAC with 'A' Grade with CGPA 3.62/4
Ranked 95 in College Category – 2021 under NIRF, Ministry of Education, Government of India
Recognised as Centre for Research Capacity Building under UGC-STRIDE Scheme
Recognised under the DBT – BUILDER Scheme, Government of India
College with “STAR STATUS” conferred by DBT, Government of India
Recognised by UGC as “College with Potential for Excellence**

**UG BOTANY NEP SYLLABUS 2021-2022 ONWARDS
FOR SEMESTER I , II, III & IV**

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 meaningful, 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.
- receive the updated subject matter, both theoretical as well as practical, such a way to foster their core competency, creative thinking and analytical learning . A botany graduate as envisioned in this framework would be sufficiently competent in the field to undertake further discipline-specific studies, as well as to begin domain-related employment.
- enhance their knowledge in the field of life sciences and are able to handle laboratory equipments and experimentation for higher education leading to research
- become a responsible citizen who is aware of the most basic domain-independent knowledge, including critical thinking and communication.
- 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 enabling the graduates to prepare for national as well as international competitive examinations, including UGC-CSIR NET and UPSC Civil Services Examination.
- inculcate an interest for nature and the need to preserve the nature by maintaining greenhouse, herbal gardens in the campus and environs

Programme structure for the under-graduate programs in Universities and Colleges [subjects with practicals] [With major Botany]

SEMESTER-I								
Group	Course Code	Title of the Course	Instruction Hours / week	Duration of Exam (Hours)	Marks			Credits
					IA	Exam	Total	
Discipline Specific Course	G507 DC1.1	Microbial Diversity and Technology	4	2.5	40	60	100	4
Discipline Specific Course	G 507 DC 2.1P	Microbial Diversity and Technology - Practicals	4	3	25	25	50	2
Open Elective Course	G 507 OE 1.1	Plants for Human Welfare	3	2.5	40	60	100	3

SEMESTER- II								
Group	Course Code	Title of the Course	Instruction Hours / week	Duration of Exam (Hours)	Marks			Credits
					IA	Exam	Total	
Discipline Specific Course	G507 DC1.2	Diversity of Non-Flowering Plants	4	2.5	40	60	100	4
Discipline Specific Course	G507DC 2.2P	Diversity of Non-Flowering Plants -Practicals	4	3	25	25	50	2
Open Elective Course	G 507 OE 1.2	Plant ropagation, Nursery management and Gardening	3	2.5	40	60	100	3

B.Sc. BOTANY: Semester – I
G507 DC1.1: Microbial Diversity and Technology

Number of Theory credits: 4	Number of lecture hours/ week : 4	Number of Practical Credits : 2	Number of practical hours / week : 4
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Course Outcomes:

At the end of the course the student should be able to:

- ❖ understand the fascinating diversity, evolution, and significance of microorganisms.
- ❖ comprehend the systematic position, structure, physiology and life cycles of microbes and their impact on humans and environment.
- ❖ gain laboratory skills such as microscopy, microbial cultures, staining, identification and preservation of microbes.
- ❖ apply microbes in research and industry

Course content

56 Hrs

Unit 1

14 Hrs

1.1 Microbial diversity: Introduction to microbial diversity; Hierarchical organization and positions of microbes in the living world: Whittaker's five-kingdom system and Carl Richard Woese's three-domain system. Habitats of microbes : soil, air, food and water. Significance of microbial diversity .

1.2 History and development of microbiology: Microbiologists and contributions of - Leeuwenhoek, Louis Pasteur, Robert Koch, Joseph Lister, Dmitri Iwanowski, Sergius Winogradsky and M W Beijerinck and Paul Ehrlich.

1.3 Microscopy: Working principle and applications of light, dark field, phase contrast and electron microscopes (SEM and TEM).

1.4 Microbiological stains : acidic, basic and special and Principles of staining. Simple, Gram's and differential staining.

Unit II

14 Hrs

2.1 Culture media for Microbes: Natural and synthetic media, Routine media -basal media, enriched media, selective media, indicator media, transport media, and storage media.

2.2 Sterilization methods : Methods of disinfection: antiseptic, tyndallization and Pasteurization. **Sterilization-**Physical methods: dry heat, moist heat, UV light, ionization radiation, filtration. Chemical methods - phenolic compounds, anionic and cationic detergents.

2.3 Microbial Growth: Microbial growth and measurement. Nutritional types of Microbes- autotrophs and heterotrophs, phototrophs and chemotrophs; lithotrophs and organotrophs.

Unit III

14 Hrs

3.1 Microbial cultures and preservation: Microbial cultures. Pure culture and axenic cultures, subculturing. Preservation methods-overlaying cultures with mineral oils, lyophilisation. Microbial culture collections and their importance. A brief account on ITCC, MTCC and ATCC.

3.2 Viruses: General structure and classification of Viruses; ICTV system of classification. Structure and multiplication of TMV, SARS-COV-2, and Bacteriophage (T2). Cultivation of viruses. Vaccines and types. Economic importance of viruses. **Viroids & Prions:** Viroids- general characteristics and structure of Potato Spindle Tuber Viroid (PSTVd); Prions - general characters and diseases.

3.3 Bacteria: General characteristics and classification.(Bergey's classification) Archaeobacteria and Eubacteria. Ultrastructure of Bacteria; Bacterial growth and nutrition. Reproduction in bacteria- asexual and sexual methods. Study of *Rhizobium* and its applications. A brief account of Actinomycetes , Mycoplasmas and Phytoplasmas - General characteristics and diseases

Unit IV

14 Hrs

4.1. Fungi: General characteristics and classification (Alexopoulos classification). Thallus organization and nutrition in fungi. Reproduction in fungi (asexual and sexual). Heterothallism and parasexuality. Type study: Morphology of *Rhizopus*, *Saccharomyces*, *Penicillium* and *Puccinia*. Morphology and reproduction of *Puccinia* Economic importance of Fungi.

4.2. Symbiotic associations:

Lichens – Structure- brief account of Crustose, foliose and fruticose and asexual reproduction .

VAM Fungi and their significance.

4.3 Microbial plant diseases- Koleroga of Arecanut, Blast Disease of Rice; Black stem rust of wheat; Red rot of sugarcane , Sandal Spike, Citrus Canker, Root Knot Disease of Brinjal.

References

1. Ananthnarayan R and Panikar JCK. 1986. Text book of Microbiology. Orient Longman Ltd. New Delhi.
2. Arora DR. 2004. Textbook of Microbiology, CBS, New Delhi.
3. William CG. 1989. Understanding microbes. A laboratory text book for Microbiology. W.H. Freeman and Company. New York.
4. Dubey RC and Maheshwari DK. 2007. A textbook of Microbiology, S. Chand and Company, New Delhi.
5. Dubey RC and Maheshwari DK. 2002. A Text book of Microbiology, S.C.Chand and Company, Ltd. Ramnagar, New Delhi.
6. Sharma R. 2006. Text book of Microbiology. Mittal Publications. New Delhi. 305pp.
7. Sharma PD. 1999. Microbiology and Plant Pathology. Rastogi publications. Meerut, India.
8. Vasanthkumari R. 2007. A textbook of Microbiology, BI Publications Pvt. Ltd., New Delhi.
9. Alexopoulos CJ and Mims CW. 1989. Introductory Mycology, Wiley Eastern Ltd., New Delhi.
10. Allas RM. 1988. Microbiology: Fundamentals and Applications, Macmillan publishing co. New York.
11. Brook TD, Smith DW and Madigan MT. 1984. Biology of Microorganisms, 4th ed. Eaglewood Cliffs. N.J. Prentice- Hall. New Delhi.
12. Burnell JH and Trinci APJ. 1979. Fungal walls and hyphal growth, Cambridge University Press. Cambridge.
13. Jayaraman J. 1985. Laboratory Manual of Biochemistry, Wiley Eastern Limited. New Delhi.
14. Ketchum PA. 1988. Microbiology, concepts and applications. John Wiley and Sons. New York.
15. Michel J, Pelczar Jr. EC and Krieg CR. 2005. Microbiology, Mc.Graw-Hill, New Delhi.

16. Powar CB and Dagainawala. 1991. General Microbiology, Vol – I and Vol – II Himalaya publishing house, Bombay.
17. Reddy S and Ram. 2007. Microbial Physiology. Scientific Publishers, Jodhpur, 385pp.
18. Sullia SB and Shantharam S. 1998. General Microbiology. Oxford and IBH publishing Co.Pvt.Ltd. New Delhi.
19. Schlegel HG. 1986. General Microbiology. Cambridge. University Press. London, 587pp.
20. Roger S, Ingrahan Y, Wheelis JL, Mark L and Page PR. 1990. Microbial World 5th edition. Prentice-Hall India, Pvt. Ltd. New Delhi.
21. Sullia SB. and Shantharam S. 2005. General Microbiology, Oxford and IBH, New Delhi.

Practical Course G 507 DC 2.1P: Microbial Diversity and Technology

List of Experiments to be conducted

Practical 1: Safety measures in microbiology laboratory and study of equipment/appliances used for microbiological studies (Microscopes, Hot air oven, Autoclave/Pressure Cooker, Inoculation needles/loop, Petri plates, Incubator, Laminar flow hood, Colony counter, Haemocytometer, Micrometer.

Practical 2: Preparation of culture media (NA/PDA) sterilization, inoculation, incubation of *E coli* / *B. subtilis*/ Fungi and study of cultural characteristics.

Practical 3: Enumeration of soil/food /seed microorganisms by serial dilution technique.

Practical 4: Preparation of agar slants, inoculation, incubation, pure culturing and preservation of microbes by oil overlaying.

Practical 5: Determination of cell count by using Haemocytometer and determination of microbial cell dimension by using Micrometer.

Practical 6: Simple staining of bacteria (Crystal violet /Nigrosine blue) / Gram's staining of bacteria

Practical 7: Isolation and study of morphology of *Rhizobium* from root nodules of legumes

Practical 8: Preparation of spawn and cultivation of paddy straw (Oyster) mushroom.

Practical 9: Study of vegetative structures and reproductive structures of any six of the following: *Albugo*, *Phytophthora*, *Rhizopus*, *Saccharomyces*, *Neurospora*/ *Sordaria*, *Puccinia*, *Agaricus*, *Lycoperdon*, *Aspergillus*/*Penicillium*, *Trichoderma*.(Depending on local availability)

Practical 10: Study of Koleroga of Arecanut, Blast Disease of Rice; Black stem rust of wheat, Red rot of sugarcane, Sandal Spike, Citrus Canker, Tobacco mosaic virus, Root Knot Disease of Brinjal.

Practical 11: Study of well-known microbiologists and their contributions through charts and photographs.

Practical-12: Visit to water purification units/Composting/ microbiology labs/dairy and farms to understand role of microbes in day today life. Field study report is to be documented in the practical record only.

**B.Sc. BOTANY: Open Elective Course
I Semester**

G 507 OE 1.1: Plants for Human Welfare

Course Outcomes:

On completion of this course, the students will be able to

- gain knowledge on the economic importance of diverse plants that offer resources to human life.
- know about the plants used as food, medicinal value and also plant sources of different economic value .
- understand the importance of plants in today's life, conservation, ecosystem and sustainability.

Number of Theory Credits	Number of lecture hours/semester	Number of practical Credits	Number of practical hours / semester
3	30	0	00

30 Hrs

Unit I

Origin of Cultivated Plants. Concept of Centres of Origin, their importance with reference to Vavilov's work. Examples of major plant introductions. Crop domestication and loss of genetic diversity (Only conventional plant breeding methods). Importance of plant bio- diversity and conservation. 02

Unit II

Wheat and Rice (origin, evolution, morphology, post-harvest processing & uses).Green revolution. Brief account of millets and their nutritional importance. 03

Unit III

Legumes: General account (including chief pulses grown in Karnataka- red gram, green gram, chick pea, soybean). Importance to man and ecosystem. 02

Unit IV

Fruits: Mango,grapes and Citrus (Origin, morphology,cultivation ,processing and uses) 02

Unit V

Cash crops: Morphology, new varieties and processing of sugarcane, products and by-products of sugarcane industry. Natural Rubber –cultivation, tapping and processing. 03.

Unit VI

Spices: Listing of important spices, their family and parts used, economic importance with special reference to Karnataka. Study of fennel, clove, black pepper and cardamom. 03

Unit VII

Beverages: Tea, Coffee (morphology, processing & uses) 02

Unit VIII

Oils and fats: General description, classification, extraction, their uses and health implications; groundnut, coconut, sunflower and mustard (Botanical name, family & uses). Non edible oil yielding trees and importance as biofuel. Neem oil and applications. 02

Unit IX

Essential Oils: General account. Extraction methods of sandal wood oil, rosa oil and eucalyptus oil. Economic importance as medicine, perfumes and insect repellents. 02

Unit X

Drug-yielding plants: Therapeutic and habit-forming drugs with special reference to Cinchona, Digitalis, *Aloe vera* and Cannabis. 03

Unit XI

Fibers: Classification based on the origin of fibers; Cotton and jute (origin morphology, processing and uses). 03

Unit XII

Forests: Forest and forest products. Community forestry. Concepts of reserve forests, sanctuaries and national parks with reference to India. Endangered species and red data book. 03

Text Books and References

1. Kochhar, S.L. (2012). *Economic Botany in Tropics*. New Delhi, India: MacMillan & Co.
2. Wickens, G.E. (2001). *Economic Botany: Principles & Practices*. The Netherlands: Kluwer Academic Publishers.
3. Chrispeels, M.J. and Sadava, D.E. (1994) *Plants, Genes and Agriculture*. Jones & Bartlett - Publishers.

B.Sc. BOTANY: Semester – II
G507 DC1.2: Diversity of Non- Flowering Plants

Number of Theory credits: 4	Number of lecture hours/ week: 4	Number of Practical Credits : 2	Number of practical hours / week : 4
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Course Outcomes:

At the end of the course the student should be able to:

- ❖ understand the diversity and affinities among Algae, Bryophytes, Pteridophytes and Gymnosperms.
- ❖ understand the morphology, anatomy, reproduction and life cycle across Algae, Bryophytes, Pteridophytes and Gymnosperms.
- ❖ understand the ecological and evolutionary significance.
- ❖ obtain laboratory skills/explore non-flowering plants for their commercial applications.

Course content

56 Hrs

Unit 1

14 Hrs

1.1 Algae: Introduction and historical development in algology. Distribution of Algae. General characteristics, classification of algae by Fritsch. Diversity- habitat, thallus organization, and alternation of generation in Algae.

1.2 Morphology and reproduction and life-cycles of *Nostoc*, *Oedogonium*, *Chara*, *Sargassum* and *Polysiphonia*. Diatoms and their importance.

1.3 Algal cultivation: a general account. Basic cultivation techniques of microalgae. Algal products- Food and Nutraceuticals, Feed stocks, food colorants; fertilizers, aquaculture feed; therapeutics and cosmetics; medicines; dietary fibres from algae. Algal blooms and toxins.

Unit II

14 Hrs

2.1 Bryophytes – General characteristics and classification (Rothmaler) of Bryophytes.

2.2 Distribution, morphology, anatomy, reproduction and life-cycles of *Riccia*, *Anthoceros*, and *Funaria*. Ecological and economic importance of Bryophytes

2.3 Pteridophytes- General characteristics and classification (Smith); Distribution, morphology, anatomy, reproduction and life-cycle in *Selaginella*, *Pteris* and *Marselia*.

Unit III

14 Hrs

3.1. Brief account of heterospory and seed habit. Stelar evolution in Pteridophytes . Affinities and evolutionary significance of Pteridophytes. Ecological and economic importance.

3.2. Gymnosperms- General characteristics. Distribution and classification of Gymnosperms (Sporne). Study of the habitat, habit, anatomy, reproduction and life-cycle in *Cycas*, *Pinus* and *Gnetum*.

3.3. Affinities and evolutionary significance of Gymnosperms. Economic importance of Gymnosperms - food, timber, industrial uses and medicines

Unit IV

14 Hrs

4.1 Origin and evolution of Plants: Origin and evolution of plants through Geological Time scale.

4.2 Paleobotany: Paleobotanical records, plant fossils, Types of plant fossils - impressions, compressions, incrustation, actual remains petrification. Radiocarbon dating. A general account of fossil Bryophytes

4.3 Fossil : Fossil taxa- *Rhynia*, *Lepidodendron*, *Cycadeoidea*. Contributions of Birbal Sahni. Birbal Sahni Institute of Paleosciences.

References

1. Chopra, G.L. 2012 A text book of Algae. Rastogi & Co., Meerut, Co., New Delhi, Depot. Allahabad.
2. Johri, Lata and Tyagi, 2012 A Text Book of, Vedam e Books, New Delhi.
3. Sharma, O.P. 1990. Text Book of Pteridophyta. McMillan India Ltd. New Delhi.
4. Sharma, O.P. 1992. Text Book of Thallophytes. McGraw Hill Publishing Co. New Delhi.
5. Sharma, O.P., 2017, Algae Singh-Pande-Jain 2004-05. A Text Book of Botany.

Rastogi Publication, Meerut.

6. Simpson M.G. 2019 . Plant Systematics , III edition . Academic Press .
7. Sambamurty, A.V.S.S.. A Text Book of Algae. I.K. International Private Ltd., New Delhi.
8. Agashe, S.N. 1995. Paleobotany. Plants of the past, their evolution, paleoenvironment and Allied plants. Hutchinson & Co., Ltd., London.
9. Anderson R.A. 2005, Algal cultural Techniques, Elsevier, London. Publication, Application in exploration of fossil fuels. Oxford & IBH., New Delhi.37
10. Eams, A.J., (1974) Morphology of vascular plants - Lower groups. Tata Mc Grew- Hill Publishing Co. New Delhi, Freeman & Co., New York.
11. Fritze, R.E. 1977. Structure and reproduction of Algae. Cambridge University Press.
12. Goffinet B and Shaw A.J. 2009, Bryophyte Biology, 2nd ed. Cambridge University Press, Cambridge. Gymnosperms
13. Srivastava, H N, 2003. Algae Pradeep Publication, Jalandhar, India.
14. Kakkar, R.K. and B.R.Kakkar (1995) The Gymnosperms (Fossils and Living) Central Publishing House, Allahabad.
15. Kumar H. D., 1999, Introductory Phycology, Affiliated East-West Press, Delhi.
16. 11. Lee, R.E., 2008, Phycology, Cambridge University Press, Cambridge. 4th edition. McGraw Hill Publishing Co., New Delhi.
17. Parihar, N.S. 1970. An Introduction to Embryophyta. Vol. I. Bryophyta. Central Book, Allahabad.
18. Parihar, N.S. (1976) An Introduction to Pteridophytes, Central Book Depot, Allahabad.
19. Parihar, N.S. 1977. The Morphology of Pteridophytes. Central Book Depot., Allahabad. Press, Cambridge.
20. Rashid, A. 1998. An Introduction to Pteridophyta. II ed., Vikas Publishing House, New Delhi.
21. Smith, G.M. 1971. Cryptogamic Botany. Vol. II. Bryophytes & Pteridophytes. Tata Tata McGraw Hill Publishing, New Delhi.
22. Smith, G.M. 1971. Cryptogamic Botany. Vol.I Algae & Fungi. Tata McGraw Hill Publishing. New Delhi.

Practical Course G 507 DC 2.2P : Diversity of Non- Flowering Plants

List of Experiments to be conducted

Practical-1: Study of morphology, classification, reproduction and lifecycle of *Nostoc*, *Oedogonium*.

Practical-2: Study of morphology, classification, reproduction and life-cycle of *Chara*, *Sargassum*, *Polysiphonia*

Practical -3: Study of important blue green algae causing water blooms in the lakes.

Practical-4: Study of morphology, classification, reproduction and life-cycle of *Riccia/ Anthoceros*. Any one locally available moss.

Practical-5: Study of morphology, classification, anatomy, reproduction and life-cycle of *Selaginella*.

Practical -6: Study of morphology, classification, anatomy, reproduction and life-cycle of *Pteris* and *Marselia*.

Practical -7: Study of morphology, classification, anatomy and reproduction in *Cycas*.

Practical -8: Study of morphology, classification, anatomy and reproduction in *Pinus*.

Practical -9: Study of morphology, classification, anatomy and reproduction in *Gnetum*.

Practical -10: Study of important ornamental ferns.

Practical -11: Preparation of natural media and cultivation of *Azolla* in artificial ponds.

Practical -12: Media preparation and cultivation of *Spirulina*.

Practical -13: Study of different algal products and fossils impressions and slides.

Practical-14: Visit to algal cultivation units/lakes with algal blooms/Fern house/ Nurseries/Geology museum/lab to study plant fossils and the report is to be documented in the practical record.

B.Sc. BOTANY: Open Elective Course

II Semester

G 507 OE 1.2: Plant Propagation, Nursery management and Gardening

Course Outcomes:

On completion of this course, the students will be able to

- ❖ gain knowledge of gardening, cultivation, multiplication, raising of seedlings of garden plants.
- ❖ get knowledge of new and modern techniques of plant propagation.
- ❖ develop interest in nature and plant life.
- ❖ understand the application of this field in floriculture, agriculture and medicine
- ❖ practice sustainable use of plant resources

Number of Theory Credits	Number of lecture hours/semester	Number of practical Credits	Number of practical hours / semester
3	30	0	00

30 Hrs

Unit I

Nursery: Definition, objectives and scope and general practices and building up of infrastructure for nursery, planning and seasonal activities. Planting - direct seeding and transplants, Soil free/soilless/ synthetic growth mediums for pots and nursery.

04

Unit II

Seed: Structure and types - Seed dormancy; causes and methods of breaking dormancy. Seed storage: Seed banks, factors affecting seed viability, genetic erosion Seed production technology. Seed testing and certification.

06

Unit III

Vegetative propagation: Air-layering, cutting, selection of cutting, collecting 06
season, treatment of cutting, rooting medium and planting of cuttings. Hardening of
plants .Green house ,mist chamber, shed root, shade house and glass house.

Unit IV

Gardening: Definition, objectives and scope. Different types of gardening - 08
landscape and home/terrace gardening, parks and its components. Plant materials and
design. Computer applications in landscaping, Gardening operations: soil laying,
manuring, watering, management of pests and diseases and harvesting.

Unit V

Sowing/raising of seeds and seedlings - Transplanting of seedlings - Study of 06
cultivation of different vegetables and flowering plants: cabbage, brinjal, lady's
finger, tomatoes, carrots, bougainvillea, roses, geranium, petunia, orchids etc.
Storage and marketing procedures. Developing and maintenance of different types of
lawns. Bonsai technique.

Text Books and References

1. Agrawal, P.K. (1993). Hand Book of Seed Technology. New Delhi, Delhi: Dept. of Agriculture and Cooperation, National Seed Corporation Ltd.
2. Bose T.K., Mukherjee, D. (1972). Gardening in India. New Delhi, Delhi: Oxford & IBH Publishing Co.
3. Jules, J. (1979). Horticultural Science, 3rd edition. San Francisco, California: W.H. Freeman and Co.
4. Kumar, N. (1997). Introduction to Horticulture. Nagercoil, Tamil Nadu: Rajalakshmi Publications.

Additional Resources:

1. Musser E., Andres. (2005). Fundamentals of Horticulture. New Delhi, Delhi: McGraw Hill Book Co.
2. Sandhu, M.K. (1989). Plant Propagation. Madras, Bangalore: Wile Eastern Ltd.

SCHEME OF ASSESSMENT

Ratio of weightage (marks) between

Internal & End Semester Examinations for THEORY: 60:40

Practicum component marks: 50

Internal component of practicum: 50 (converted to 25)

Assessment Type	Weightage in marks
Continuous Assessment of all practical experiments	15
Attendance	05
Model practical Test	20
Maintenance of Records	05
Viva	05

End semester Practicum : 50 (converted to 25)

THEORY FORMATIVE ASSESSMENT: 40

Assessment Type	Weightage in marks
Two internal tests	10×2=20
Assignment	05
Attendance	05
Continuous Unit wise tests (objective/MCQ)	05
Group/ teams of two projects:	05

THEORY SUMMATIVE ASSESSMENT: 60

QUESTION PAPER PATTERN: DC & OE

Time: 2.5 HRS

Max Marks: 60

Part – A

1) Answer **Any Five** of the following
(Five to be answered out of eight)

5X2 =10

Part – B

2) Answer **Any Six** of the following
(Four to be answered out of eight)

6X5=30

Part-C

3) Answer **any Two** of the following
(Two to be answered out of Four)

2X10=20

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

Part A- Eight Questions from four units with equal weightage

Part B- Eight Questions from four units with equal weightage

Part C- Four questions from four units with equal weightage

QUESTION PAPER PATTERN: [PRACTICALS]
DC-2.1 P Microbial Diversity and Technology

Time: 3HRS

Max Marks: 50

- | | |
|---|----------|
| 1. Identify the given Material A . Leave the preparation for inspection
(Preparation-3, Labelled diagram-2, Identification with classification-1) | 6 |
| 2. Identify B, C and D with Labelled sketch and Reasons

(Labelled Sketch = 1, Classification = ½, Identification ½ , Reasons =2) | 3x4=12 |
| 3. Perform gram staining from the given sample E
(Principle- 2, Slide Preparation- 3, Procedure-2, Result-1) | 8 |
| 4. Write Critical Notes on F,G,H and I
(Identification =1, Critical notes=2) | 4x3=12 |
| 5. Determine the cell dimension of the given microbial cell using micrometer
(Performance- 2, Procedure-3 , Calculation & Result- 3) | 8 |
| 6. Write a note on contributions of the given scientist J | 4 |

Note to the Examiners

1. Specimen **A** (fungus)
2. Specimen **B, C** and **D** – from microfungi
3. Gram +/- **E**
4. Critical notes **F , G, H** and **I** - macroscopic specimens from viral diseases/ bacterial diseases/ mycoplasmal diseases / fungal diseases
5. Cell dimension of fungal spores
6. Contribution of any Microbiologist.

QUESTION PAPER PATTERN: [PRACTICALS]

DC -2.2 P Diversity of Non- Flowering Plants

MAX MARKS: 50

TIME: 3 HR

1. Prepare a Temporary mount of material **A**. Identify and leave the preparation for inspection. **5**
(Preparation-2, labelled sketch -2, identification -1)
2. Prepare a Temporary mount of material **B** . Identify and leave the preparation for inspection. **6**
(Preparation-2, labelled sketch -3, identification -1)
3. Identify Material **C** and **D**. Leave the preparation for inspection **2X6=12**
(Preparation-3, Labelled sketch-2, Identification with classification-1)
2. Write Critical Comments on **E,F , G** and **H** **4X3=12**
(Identification- 0½, Reasons-2½)
3. Identify the given Slides **I, J, and K** **3X5=15**
(Identification-1, Labelled sketch- 2 , Reasons-2)

Note to the Examiners

1. Specimen **A** – Cyanobacteria / Algae
2. Specimen **B** - Bryophyte
3. Specimen **C and D** - Pteridophyte and Gymnosperm
4. Specimen **E, F, G** and **H**- one each from the above mentioned groups.
5. Specimen **I, J** and **K** – one each from the above mentioned groups.

Programme structure for the under-graduate programs in Universities and Colleges [subjects with practicals] [With major Botany]

SEMESTER-III								
Group	Course Code	Title of the Course	Instruction Hours / week	Duration of Exam (Hours)	Marks			Credits
					IA	Exam	Total	
Discipline Specific Course	G507 DC 1.3	Plant Anatomy and Developmental Biology	4	2.5	40	60	100	4
Discipline Specific Course	G 507 DC 2.3P	Plant Anatomy and Developmental Biology -Practicals	4	3	25	25	50	2
Open Elective Course	G 507 OE 1.3	Medicinal and Aromatic plants	3	2.5	40	60	100	3
SEMESTER- IV								
Group	Course Code	Title of the Course	Instruction Hours / week	Duration of Exam (Hours)	Marks			Credits
					IA	Exam	Total	
Discipline Specific Course	G507 DC1.4	Ecology and Conservation Biology	4	2.5	40	60	100	4
Discipline Specific Course	G507DC 2.4P	Ecology and Conservation Biology - Practical	4	3	25	25	50	2
Open Elective Course	G 507 OE 1.4	Plant Biodiversity and Conservation	3	2.5	40	60	100	3

B.Sc. BOTANY: Semester - III

G507 DC1.3: PLANT ANATOMY AND DEVELOPMENTAL BIOLOGY

Number of Theory credits: 4	Number of lecture hours/ week : 4	Number of Practical Credits : 2	Number of practical hours / week : 4
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Course Outcomes:

On completion of this course, the students will be able to:

1. Understand various levels of organization in a plant body with an outlook in the relationship between the structure and function through comparative studies.
2. Observe and classify the floral variations from the premises of college and house.
3. Understand the various reproductive methods sub-stages in the life cycle of plants
4. Observe and classify the embryological variations in angiosperms.
5. Understand evolution based on the variations in reproduction among plants.

PLANT ANATOMY

Unit I: PLANT CELL STRUCTURE AND TISSUES

14 hours

1.1 Introduction: objective and scope of Plant Anatomy, Plant cell structure – nature of plant cell wall.

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

1.3 Structure and function of root apical meristem (RAM): Root cap, quiescent centre

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

1.5 Applications: in systematics, forensics and Pharmacognosy.

DEVELOPMENTAL BIOLOGY

Unit II: MORPHOGENESIS

14 hours.

2.1 Morphogenesis in plants - Differentiation of root, stems and leaf. Types of vascular bundles and vascular cambium

2.2 Structure of Dicot root: primary and secondary structures (Tridax/Sunflower/Papaya), Structure of monocot root (Maize).

2.3 Structure of Dicot stem: Primary and secondary structures (Tridax/Sunflower), Structure of Monocot stem (Maize), Nodal anatomy.

2.4 Structure of Dicot leaf: primary structure (Tridax/Sunflower), primary structure of Monocot leaf (Maize), Stomatal types.

2.5 Anomalous secondary growth: Aristolochia / Bignonia / Boerhaavia (dicot stem), Dracaena (monocot stem)

Unit III: DIFFERENTIATION

14 hours.

3.1 Differentiation and cell polarity in acellular (*Dictyostelium*), Unicellular (*Acetabularia*) and multicellular system (root hair and stomata formation), Cytohistological zonation and Ultrastructure of meristems.

3.2 Organogenesis: Differentiation of root, stem, leaf and axillary buds, bud dormancy, Significance of anatomy

3.3 Mechanism of leaf primordium initiation, development and Phyllotaxis (Diversity in size and shape of leaves)

3.4 Transition from vegetative apex into reproductive apex

3.5 Developmental patterns at flowering apex: ABC model specification of floral organs.

Unit IV: REPRODUCTIVE BIOLOGY

14 hours

4.1 Introduction, Scope, interdisciplinary aspects and contributions of Indian embryologists: P.Maheshwari, K R Shivanna

4.2 Microsporangium: Development and structure of mature anther, Anther wall layers, Tapetum -types, structure and functions and sporogenous tissue. Microsporogenesis- Microspore mother cells, microspore tetrads, Pollinia. Microgametogenesis – Formation of vegetative and generative cells, structure of male gametophyte.

4.3 Megasporangium – Structure of typical Angiosperm ovule.Types of ovule- Anatropous, Orthotropous, Amphitropous, Circinotropous.Megagametogenesis – Types of development of Female gametophyte/embryosac- monosporic- *Polygonum* type. Structure of mature embryosac.

4.4 Pollination and fertilization: Structural and functional aspects of pollen (cell wall) , stigma and style. Post pollination events, Process and significance of double fertilization & triple fusion - recognition, pollen - stigma interaction, growth of pollen tube, chalazogamy, porogamy, mesogamy, Post fertilization changes.

4.5 Endosperm: Types and its biological importance. Free nuclear (*Cocos nucifera*) , cellular (*Cucumis*), helobial types. Ruminant endosperm.

4.6 Embryogenesis: Structure and composition of zygote, Dicot (*Capsella bursa-pastoris*) and Monocot (*Najas*) embryo development. A general account of seed development.

B.Sc. BOTANY: Semester - III
Practical Course G 507 DC 2.3 P
PLANT ANATOMY AND DEVELOPMENTAL BIOLOGY

LIST OF EXPERIMENTS TO BE CONDUCTED

Practical No.1

- i) Study of meristem (Permanent slides/ Photographs).
- ii) Study of Simple Tissues (Parenchyma, Collenchyma and Sclerenchyma) and Complex Tissues (xylem and phloem).

Practical No.2

Maceration technique to study elements of xylem and phloem, Study of primary structure of dicot root, stem and leaf

Practical No.3

Study of primary structure of monocot root, stem and leaf

Practical No. 4

Study of Normal secondary growth structure in dicot stem and root and Anomalous secondary growth

Practical No. 5

Study of stomata (any four types) with the help of locally available plant materials

Practical No. 6

Permanent slides of Young and mature anther, male gametophyte. Mounting of Pollen grains of Grass and Hibiscus and Pollinia of Calotropis

Practical No. 7

Pollen germination (hanging drop method) and Effect of Boron and Calcium on pollen germination

Practical No. 8

Permanent slides of types of ovules- orthotropous, anatropous, campylotropous, types of placentation: Axile, Marginal and Parietal types. Sectioning of ovary, for the studied types of placentation

Practical No. 09

Mounting of embryo: Tridax and Cyamopsis, Mounting of endosperm: Cucumis, Permanent slides of dicot and monocot embryo

Practical No. 10 and 11

Minor project work in groups of 3-5 students, from the following list

- a) Study of pollen morphology of different flowers with respect to shape, colour, aperture etc.
- b) Pollen germination of different pollen grains and calculate percentage of germination collected from different localities/ under different conditions.
- c) Study of placentation of different flowers.
- d) Any other relevant study related to Anatomy / Embryology.

Note : Minor project work should be evaluated on students presentation, discussion and viva

Text Books for Reference:

1. Bhojwani and Bhatnagar, Introduction to Embryology of Angiosperms –Oxford & IBH, Delhi
2. Bhojwani Sant Saran, 2014.Current Trends in the Embryology of Angiosperms, Woong-Young Soh, Springer Netherlands,
3. Coutler E. G. , 1969. Plant Anatomy – Part I Cells and Tissues – Edward Arnold, London.
4. Dickison, W.C. (2000). Integrative Plant Anatomy, Harcourt Academic Press, USA
5. Eames A. J. - Morphology of Angiosperms - Mc Graw Hill, New York.
6. Esau, K. 1990. Plant Anatomy, Wiley Eastern Pvt Ltd New Delhi
7. Evert, R.F. (2006) Esau's Plant Anatomy: Meristem, Cells, and Tissues of the Plant Body: Their Structure, Function and Development. John Wiley and Sons, Inc
8. Fahn, A.1992. Plant Anatomy, Pergamon Press, USA
9. Johri, B.M. I., 1984.Embryology of Angiosperms, Springer-Verlag, Netherlands.
10. Karp G., 1985. Cell Biology; Mc.Graw Hill Company
11. Maheshwari,P 1950. An introduction to the embryology of angiosperms. New York: McGraw-Hill
12. Mauseth, J.D. (1988). Plant Anatomy, the Benjamin/Cummings Publisher, USA.
13. Nair P .K .K - Pollen Morphology of Angiosperms - Scholar Publishing House, Lucknow
14. Pandey S.N. 1997, Plant Anatomy and Embryology .A. Chadha, Vikas Publication House Pvt Ltd;
15. Pandey, B. P., 1997. Plant Anatomy, S.Chand and Co. New Delhi

16. Raghavan, V., 2000. Developmental Biology of Flowering plants, Springer, Netherlands.
17. Saxena M. R. – Palynology – A treatise - Oxford & I. B .H., New Delhi.
18. Shivanna, K.R., 2003. Pollen Biology and Biotechnology. Oxford and IBH Publishing Co. Pvt.Ltd. Delhi.
19. Vashishta .P.C .,1984. Plant Anatomy – Pradeep Publications – Jalandhar
20. Vashishta, P.C. 1997. Plant Anatomy, Pradeep Publications

**B.Sc. BOTANY: Open Elective Course
III Semester**

G 507 OE 1.3 : Medicinal and Aromatic plants

30 Hrs

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 medicinal and aromatic plants
-

UNIT 1

10 hrs

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

1.2 Promotion of medicinal plant sector at national level: National Medicinal Plant Board and State Medicinal Plant Boards - objectives and functions

1.3 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). Primary and secondary metabolites, Biological testing of herbal drugs - Phytochemical screening tests for secondary metabolites (alkaloids, flavonoids, steroids, triterpenoids, phenolic compounds)

UNIT 2

10 hrs

2.1 Bioprospecting: Introduction, a brief note on Indigenous Knowledge Systems, Indigenous people and protected areas, Community Biodiversity Registers.

Intellectual property rights including patents, copyrights, trademarks, geographical indicators and trade secrets etc. Indian Patent Act, conditions for patenting, IPRs in relation to traditional knowledge and culture; Bio-piracy.

2.2 Ethnobotany: Introduction, Scope and its Importance

Medico-ethnobotanical sources: in India, Distribution, Family, Botanical Name, Parts used and Therapeutic uses and 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, Anamirta cocculus, Piper longum, Garcinia indica, Plumbago indica, Terminalia chebula, Terminalia arjuna, Cyperus rotundus, Cordia dichotoma, Strychnos nux-vomica

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

UNIT 3

10 hrs

3.1 Aromatic plants- Important aromatic plants of India with their systematics, geographical distribution and uses. Introduction and historical background of aromatic plants. Major, minor and less known aromatic plants of India. Taxonomic descriptions and uses of important aromatic plants – citronella, damask rose, geranium, large cardamom, lavender, lemon grass, mentha, holy basil, patchouli, rosemary, vetiver, artemisia, eucalyptus .

Aromatic spices - clove, cinnamon, nutmeg, ajwain, curryleaf

3.2 Flavouring and Perfumery Products: Aromatic and cosmetic products. Raw material for perfumes, Cosmetic Industries. Use of *Rosa damascena, Vanilla planifolia, Santalum album, Eucalyptus globulus, Ocimum sanctum* in Flavouring and Perfumery Products . Extraction of Essential oil.

REFERENCES

1. Trivedi P C, 2006. Medicinal Plants: Ethnobotanical Approach, Agrobios, India. 2. Purohit and Vyas, 2008. Medicinal Plant Cultivation: A Scientific Approach, 2nd edn. Agrobios, India.
2. Herbal plants and Drugs Agnes Arber, 1999. Mangal Deep Publications.
3. Kokate C.K. et al. 1999. Pharmacognosy, Nirali Prakashan
4. Colton C.M. 1997. Ethnobotany – Principles and applications. John Wiley and sons, Chichester
5. Trivedi P C, 2006. Indian Medicinal Plants , Agrobios, India.
6. Bhattacharjee S.K., 2004. Handbook of Medicinal and Aromatic Plants
7. A.K. Sharma, 2006, Recent Progress in Medicinal Plants Vol.12, Globalization of Herbal Health

B.Sc. BOTANY SEMESTER IV

G507 DC1.4 Ecology and Conservation Biology

Number of Theory credits: **4** Number of lecture hours/ week : **4** Number of Practical Credits : **2** Number of practical hours / week : **4**

Course outcomes:

On Completion of this Course students will be able to

1. learn various types of ecosystems and its significance in biodiversity conservation
2. understand ecological concepts like succession and plant adaptations, concept of sustainability
3. learn the practical application of research methodologies in ecology with reference to community studies
4. evaluate sustainable management related to local and global issues
5. get knowledge on the recent issues associated with the environment

Unit 1

14 hours

1.1 Introduction to Ecology :

Definitions, Principles of Ecology, Brief History, Major Indian Contributions, Scope and importance. Ecological levels of organisation.

1.2 Ecological factors: Climatic factors: light, temperature, precipitation and humidity.

Edaphic factors: Soil and its types, soil texture, soil profile, soil formation; physico-chemical properties of soil - mineral particle, soil pH, soil aeration, organic matter, soil humus and soil microorganisms.

1.3 Ecological groups of plants and their adaptations: Morphological and anatomical adaptations of

Hydrophytes: Morphological adaptations in *Pistia*, *Eichhornia*, *Hydrilla*, *Nymphaea*.

Anatomical adaptations in *Hydrilla* (stem) and *Nymphaea* (petiole).

Xerophytes: Morphological adaptations in *Asparagus*, *Casuarina*, *Acacia*, *Aloe vera*, *Euphorbia tirucalli*. Anatomical adaptations in phylloclade of *Casuarina*.

1.4 Epiphytes: Morphological adaptations in *Acampe*, *Bulbophyllum*. Anatomical adaptations in epiphytic root of *Acampe/Vanda*.

Halophytes: study of Vivipary in mangroves, Morphology and anatomy of Pneumatophores.

Unit II

14 hours

2.1 Ecosystem Ecology: Introduction, types of ecosystems with examples -terrestrial and aquatic, natural and artificial.

Structure of ecosystem: Biotic and Abiotic components, detailed structure of a pond ecosystem.

Ecosystem functions and processes: Food chain-grazing and detritus; Food web. Ecological pyramids -Pyramids of energy, biomass and number. Principles of Energy flow in ecosystem.

2.2 Ecological succession: Definition, types- primary and secondary. General stages of succession. Hydrosere and xerosere.

2.3 Community Ecology: Community and its characteristics – frequency, density, Abundance, cover and basal area, phenology, stratifications, life-forms. Concept of Ecotone and Ecotypes.

2.4 Ecological methods and techniques: Methods of sampling plant communities – transects and quadrats. Remote sensing as a tool for vegetation analysis, land use – land cover mapping.

2.5 Population Ecology: Population and its characteristics – Population density, natality, mortality, age distribution, population growth curves and dispersal.

Unit III

14 hours

3.1 Phytogeography :

Theory of land bridge, theory of continental drift, polar oscillations and glaciations. Centre of origin of plant – Vavilov's concept, types. Phytogeographical regions – concept, phytogeographical regions of India.

3.2 Vegetation types of Karnataka – Composition and distribution of evergreen, semi-evergreen, deciduous, scrub, mangroves, shola forests and grasslands. An account of the vegetation of the Western Ghats.

3.3 Environmental issues

Pollution: Water pollution: Causes, effect, types; water quality indicators, water quality standards in India, management of water pollution (Waste water treatment).

Water pollution disasters – National mission on clean Ganga, Minimata

3.4 Air pollution: Causes, effect, air quality standards, acid rain, control measures

Soil pollution: Causes, effect, solid waste management, control measures of soil pollution.

Unit IV

14hours

4.1 Biodiversity: Definition, types of biodiversity - habitat diversity, species diversity and genetic diversity, Sustainable Development Goals in biodiversity conservation.

Values of Biodiversity – Economic and aesthetic value, Medicinal and timber yielding plants, wild relatives of crop plants, NTFP. Threats to biodiversity.

4.2 Concept of Biodiversity Hotspots, Biodiversity hot spots of India.

4.3 Concept of endemism and endemic species.

IUCN plant categories with special reference to Karnataka/ Western Ghats.

Biodiversity Conservation- Indian forest conservation act (1980) , Biodiversity bill (2002).

4.4 Conservation methods – *In-situ* and *ex-situ* methods

In-situ methods – Biosphere reserves, National parks, Sanctuaries, Sacred groves.

Ex-situ methods- Botanical gardens, Seed bank, Gene banks, Pollen banks, Culture collections, Cryopreservation.

SUGGESTED REFERENCE BOOKS:

1. Sharma, P.D. 2018. Fundamentals of Ecology. Rastogi Publications.
2. Odum E.P. (1975): Ecology By Holt, Rinert & Winston.
3. Oosting, H.G. (1978): Plants and Ecosystem Wadworth Belmont.
4. Kochhar, P.L. (1975): Plant Ecology. (9th Edn.,) New Delhi, Bombay, Calcutta-226pp.,
5. Kumar, H.D. (1992): Modern Concepts of Ecology (7th Edn.,) Vikas Publishing Co., New Delhi.
6. Kumar H.D. (2000): Biodiversity & Sustainable Conservation. Oxford & IBH Publishing Co Ltd. New Delhi.
7. Newman, E.I. (2000): Applied Ecology, Blackwell Scientific Publisher, U.K.
8. Chapman, J.L & M.J. Reiss (1992): Ecology (Principles & Applications). Cambridge University Press, U.K.
9. Malcolm L. Hunter Jr., James P. Gibbs, Viorel D. Popescu, 2020. Fundamentals of Conservation Biology, 4th Edition. Wiley-Blackwel.
10. Saha T. K., 2017. Ecology and Environmental Biology. Books and Allied Publishers.

B.Sc. BOTANY: Semester - III
Practical Course G 507 DC 2.4 P

Ecology and Conservation Biology

List of Practicals

1. Determination of pH of different types of Soils, water holding capacity of soil samples, soil texture of different soil samples Estimation of salinity of soil/water samples.
2. Study of Ecological instruments – Wet and Dry thermometer, Altimeter, Hygrometer, Soil thermometer, Rain Gauge, Barometer, etc
3. Hydrophytes: Morphological adaptations in *Pistia*, *Eichhornia*, *Hydrilla*, *Nymphaea*. Anatomical adaptations in *Hydrilla*(stem) and *Nymphaea* (petiole).
4. Xerophytes: Morphological adaptations in *Asparagus*, *Casuarina*, *Acacia*, *Aloe vera*, *Euphorbia tirucalli*. Anatomical adaptations in phylloclade of *Casuarina*, *Nerium leaf*
5. Epiphytes: Morphological adaptations in *Acampe*, *Bulbophyllum*, *Drynaria*. Anatomical adaptations in epiphytic root of *Acampe/ Vanda*.
6. Halophytes: study of Vivipary in mangroves, Morphology and anatomy of Pneumatophores.
7. Study of a pond/forest ecosystem and recording the different biotic and abiotic components
8. Demonstration of different types of vegetation sampling methods – transects and quadrats. Ecological studies using Simpsons Index, Importance Value Index – Relative Abundance, Relative frequency, Relative basal area and biomass
9. Application of remote sensing to vegetation analysis using satellite imageries
10. Field visits to study different types of local vegetations/ecosystems and the report to be written in practical record book.
11. Determination of Biological oxygen demand (BOD)
12. Demonstration of Chemical oxygen demand (COD)

G507 DC 2.3P PLANT ANATOMY AND DEVELOPMENTAL BIOLOGY

TIME: 3HRS

MAX MARKS: 50

- | | | |
|----|---|--------|
| 1. | Perform the procedure with the specimen A
(Mounting -3, Labelled sketch-2, identification -1) | 6 |
| 2 | Identify Material B and C . Leave the preparation for inspection
(Preparation-3, Labelled sketch-2, Reasons -3, Identification -1) | 9x2=18 |
| 3. | Perform the procedure and identify the type of stomata from material D
(Preparation-3, Labelled sketch-2, Identification -1) | 6 |
| 4. | Identify and comment on the slides E,F,G,H
(Identification-1, Reasons – 2, Labelled sketch-2) | 5x4=20 |

Note to the Examiners

Specimen **A** mounting of pollen grains/ embryo/ pollen germination

Specimen **B, C** – one from stem & one from root, Monocot or dicot

Specimen **D** – Leaf for one type of stomata among any 4 types

Specimen **E, F, G, H** – Permanent slides from Embryology one each from each category

G507 DC2.4P ECOLOGY AND CONSERVATION BIOLOGY

TIME: 3HRS

MAX MARKS: 50

1. Prepare a temporary stained section of the given specimen **A** and leave it for inspection
(Preparation -4, sketch & label-4, identification of the group with ecological features -4)

12x1=12

2. Perform the Experiment **B** from the sample 6

(Performance -3, Calculation & result -3)

3. Identify and comment on the components of the given ecosystem **C** 8

(Description of ecosystem-2, identification & comment on the components -6)

4.. Solve ecological Problem **D** 8

(Derivation- 6, Answer -2)

5. Identify and comment on the spotters/ slides **E, F, G, H** 4x4=16

(Identification-1, comment-3)

Note to the Examiners

Specimen **A** for sectioning from any ecological group

Specimen **B** – BOD/ salinity

Specimen **C** – Pond Ecosystem

Specimen **D** – Simpsons Index / Importance Value Index – Relative Abundance, Relative frequency,
Relative density

Specimen **E, F, G, H** – 2 Permanent slides & 2 spotters from ecological groups one each from each category