

II Jai Sri Gurudev II
Sri Adichunchanagiri Shikshana Trust

BGS Science Academy and Research Center

(Affiliated to Bengaluru North University)
Jnanagangothri Campus, Agalagurki, Chikkaballapura-562103.



DEPARTMENT OF BOTANY

SYLLABUS

B.Sc., BOTANY

**QUESTION PAPER FORMAT
THEORY EXAMINATION**

Marks for each question	Number of question to be		Total Marks
	Answered	Out of	
A. 2	10	12	20
B. 5	4	6	20
C. 10	3	5	30
	Total		70

BENGALURU NORTH UNIVERSITY

**B.Sc., Degree Examination
(Undergraduate Credit Based Semester Scheme)**

**BOTANY
ALL PAPER**

Time: 3 hours

Max. Marks: 70

- A. Explain / Define any ten of the following in **two** or **three** sentences: (10x2=20)
- B. Write critical notes on any **four** of the following (4x5=20)
- C. Give a comprehensive account on any **three** of the following (3x10=30)

INTERNAL ASSESSMENT

1. THEORY- 30 MARKS –

Class Attendance = 5 (>51%-1, >61%-2, >71%-3, >81%-4 >90%-5, Long Absent- 0)

Assignment= 5 (Certificate, content sheet-0.5, Introduction 0.5, description-0.5, pictures or diagrams-1, summary-0.5, references-0.5, correct writing without plagiarism-1 and in time submission -0.5, Absent- 0)

Seminar = 5 (Presentation: Excellent-5, Good-4, Average-3, Satisfactory-2, Absent- 0)

Project = 5 (Correct and in time submission-5, Good-4, Average-3, Satisfactory-2, Absent- 0)

Test = 2 (5 marks each= >85%-5, >70%-4, >55%-3, >35%2, <35%-1, Absent- 0)

2. PRACTICAL- 15 MARKS –

Continues Assessment = 5 (Attendance- 2.5, performance in lab- 2.5)

Submissions or Maintainance of Plants in the college for lab purpose (2.5) and Regular Record submission (2.5)= 5,

Test = 5 (>85%-5, >70%-4, >55%-3, >35%2, <35%-1, Absent- 0)

VI SEMESTER

PAPER-VII: CYTOLOGY, GENETICS, EVOLUTION AND PLANT BREEDING 39 hrs

UNIT I CELL & CHROMOSOME BIOLOGY 13 hrs

Cell as a fundamental unit of life and organism. Structure of eukaryotic chromosome; centromere, kinetochore and telomere. Nucleosome and its importance in the organisation of eukaryotic chromosome. Types of Chromosomes; biarmed and holocentric types.

Cell Division- Mitosis- Phases, mitotic apparatus, cytokinesis, mitotic inhibitors, significance of mitosis; Meiosis- phases of meiotic cycle, cytological proof of crossing over, synaptonemal complex. Brief study on Apoptosis (PCD).

UNIT II MENDELIAN GENETICS 13 hrs

Biography of Mendel in brief: Mendel's experiments: Monohybrid cross – law of dominance, law of segregation, purity of gametes. Homozygous, heterozygous, phenotype, genotype, monohybrid test cross, Dihybrid cross- law of independent assortment, dihybrid test cross, incomplete dominance (*Mirabilis jalapa*, Snapdragon).

Modification of Mendelian ratios: (With reference to plant examples). Interaction of genes, epistasis (dominant & recessive); supplementary factors, complementary factors: Polygenic inheritance in Maize (Self Sterility in *Nicotiana*), Linkage & Crossing over (in Maize).

SEX DETERMINATION: Chromosomal mechanism of sex determination methods. XX –XY, ZZ – ZW & XX – XO (Sex determination in *Melandrium*) and genetic problems related to topics.

UNIT III EVOLUTION 13 hrs

Big Bang theory, Origin of life, theories of evolution, modern concepts of evolution, role of mutations in evolution, Gene duplication (2R hypothesis), Numerical changes in chromosome number, polyploidy and aneuploidy - trisomics and monosomics and Chromosomal aberrations.

PLANT BREEDING

Historical account and objectives of plant breeding. Vegetative propagation methods (underground plant parts and isolated plant parts - cutting, grafting, layering, gootee, clones) Hybridization (intergeneric and interspecific), maintenance of germplasm, pollen banks, quarantine methods.

PRACTICAL PAPER – VII

CYTOLOGY, GENETICS, EVOLUTION AND PLANT BREEDING

Total Units - 13

- | | |
|--|----------------|
| 1. Preparation of cytological stains - Aceto carmine & Aceto orcein. | 1 Unit |
| 2. Mitosis from <i>Allium</i> root tips—Aceto orcein. | 3 Units |
| 3. Meiosis from <i>Allium</i> flower buds- Aceto carmine. | 3 Units |
| 4. Karyotype and Idiogram : Camera Lucida drawing. | 1 Unit |
| 5. Permanent slides of Mitosis. | 1 Unit |
| 6. Permanent slides of Meiosis. | 1 Unit |
| 7. Emasculation and bagging of the flower buds of available species. | 1 Unit |
| 8. Genetic problems. | 2 Units |
| 9. Record and Submission- 6 Slides (3 Mitosis and 3 Meiosis.) | |

PRACTICAL QUESTION PAPER- VII
CYTOLOGY, GENETICS, EVOLUTION AND PLANT BREEDING

Time: 3 hours

Max Marks: 35

1. Prepare a temporary mitotic, slide from material **A** identify the stage with diagram. **6**
2. Prepare a temporary meiotic slide from material **B** identify the stage with diagram. **6**
3. Identify and comment on **C** along with a sketch (only Karyotype). **4**
4. Identify and comment on slides **D** and **E** with suitable sketches. **3+3=6**
5. Solve the Genetic Problem **F** **5**
6. Record and Submission **5+3=8**

Scheme of Valuation

1. Preparation- **4** marks, identification of stage - **1** mark and diagram **1** mark
2. Preparation - **4** marks, identification of stage - **1** mark and diagram **1** mark
3. Karyotype - slide or sketch, identification-**1** mark, diagram- **1** mark, comment- **2** Marks
4. Slides from meiosis and mitosis identification **0.5** mark, sketch **0.5** mark and comment **2** marks
5. Genetic problems from
 - i. Dihybrid cross and test cross
 - ii. Incomplete dominance
 - iii. Complementary factors
 - iv. Supplementary factors
 - v. Epistasis - **5** marks
6. i. Record - **5** marks
- ii. 3 Mitotic and 3 Meiotic permanent slides $\frac{1}{2}$ mark each - **3** marks

REFERENCES

1. Benjamine A. 2012, **Genetics- conceptual approach 4 edition**. W.H. Freeman and company, New york.
(<http://libgen.li/ads.php?md5=92628898ed488f11aad59014618abe7b>)
2. Bruce Alberts, Alexander Johnson, Julian Lewis, Martin Raff, Keith Roberts and Peter Walter 2007, **Molecular Biology of the Cell: 5 edition**. Garland Science, 1526 illustrations. Package with Media DVD.
(<http://libgen.li/ads.php?md5=44ea074d6f741d2f1fa1e005775f361e>)
3. Chaudhari, H.K. 1983. **Elementary Principles of Plant Breeding**, TMH publishers Co., New Delhi.
<http://libgen.li/ads.php?md5=59c2ff49d62ae51bcbaf8e205cedf50b>
<http://libgen.li/ads.php?md5=6bb121eb1100ea889107d287ff0b13c7>
4. De Robertis E.D.P. and De Robertis, E.M.F Jr, 2002. **Cell and Molecular Biology**, USA cippocott,
5. Gardener E.J. and Sanstad D.P. 1984. **Principles of Genetics**, John wiley Publishing Co., New Delhi
(<http://libgen.li/ads.php?md5=cfd100e0aece7cc061a4a60b9cbd6c4e>)
6. Goodenough, U. 1990. Genetics, 3 **edn.**, Saunders College Publishers, New York.
7. Gupta. p.k. 1994, **Genetics**, Rastogi publications, New Delhi.
8. Jain J, Sanjayjain, I and Nitin jain, 2005. **Fundamentals of Biochemistry**, S.Chand & company Pvt Ltd., New Delhi.
(<http://libgen.li/ads.php?md5=399b374fa872321f88610169b9642dc5>)
9. Jha, A. P. 1993, **Genes and Evolution**. Mac Millan India Ltd., New Delhi.
10. John Ringo, 2004. **Fundamental genetics**, India Cambridge univ., New Delhi.
11. Mahesh. S. 2008. **Plant Molecular Biotechnology**, New age Int. Publ, New Delhi.
12. Nelson D, I and Cox, M. M. 1996. **Principles of Biochemistry**. Macmillan worth Publications, New Delhi
(<http://libgen.li/ads.php?md5=1e73710f18590d2b6217a8e86cff45d5>)
13. Sadhu M.K. 1996. **Plant propagation**, New age international publishers, New Delhi.
<http://libgen.li/ads.php?md5=f3fc75fc3df7ecc20baa918655483f80>

- <http://libgen.li/ads.php?md5=e24227a4b35fef81c2fe27a2baa8c867>
<http://libgen.li/ads.php?md5=ac841d7e9b81a344cc53132df3df317c>
14. Sharma, J.R. 1994. **Principles and Practice of Plant Breeding**, Tata McGraw- Hill Publishers, New Delhi
 15. Shukla R.S. and P.S.Chandel, 2004. **Cytogenetics, Evolution and Plant Breeding** S.Chand and company Pvt Ltd., New Delhi <https://www.pdfdrive.com/cell-division-genetics-and-molecular-biology-cell-division-genetics-and-molecular-biology-e22406140.html>
<http://libgen.li/ads.php?md5=c1ec58cc3dedf122441a07a185921a18>,
<http://libgen.li/ads.php?md5=77d115bd312005056db29514b79144df>
 16. Sinnot, E.W., Dunn, L.C. & Dobzonsky, T. 1958. **Principles of Genetics**. Tata McGraw Hill, New York.
 17. Strickberger, M.W. 2002. **Evolution**. Jones and Barlett Publishers, Sudbury.
<http://libgen.li/ads.php?md5=e5d17bd7b9b97f2137afb47a10b898c6>
 18. http://www.biology.arizona.edu/mendelian_genetics/mendelian_genetics.html
 19. https://asutoshcollege.in/Study_Material/principles_of_plant_breeding.pdf
 20. <http://agrimoon.com/wp-content/uploads/Principles-of-Plant-Breeding.pdf>
 21. <https://gtu.ge/Agro-Lib/Principles%20of%20Plant%20Genetics%20and%20Breeding.pdf>



**VI SEMESTER
PAPER –VIII: PLANT PHYSIOLOGY – III**

39 hrs

UNIT I ENZYMES

13 hrs

Nomenclature, classification, chemical composition, prosthetic groups, coenzymes, cofactors, vitamins, properties of enzymes, mechanism of enzymes action, enzyme kinetics, factors affecting enzyme activity, Inhibition of enzyme action (Competitive, Non Competitive, feedback), Allosteric enzyme.

Nitrogen Metabolism:

Sources of nitrogen, Nitrogen fixation, *nif* genes in relation to symbiotic fixation in *Rhizobium*. Synthesis of amino acids and Nitrogen cycle.

UNIT II BIOENERGETICS

13 hrs

Photosynthesis – Introduction, ultra structure of the chloroplast, photosynthetic apparatus, principle of light absorption, Emerson's enhancement effect, photosystems I & II, Light reaction – Hill reaction, photophosphorylation (cyclic, non-cyclic), carbon reactions (Calvin Cycle, C4 – Pathway, CAM), Factors affecting the process.

Photorespiration– Organelles involved, mechanisms and significance.

Respiration- Introduction, mechanism of aerobic respiration – glycolysis, TCA cycle, ETS and oxidative phosphorylation, mechanism of anaerobic respiration (alcoholic fermentation and lactic acid fermentation), Respiratory Quotient and its significance, factors affecting respiration.

UNIT III PLANT GROWTH AND GROWTH REGULATORS

13hrs

Definitions of growth, Kinetics, Factors affecting growth, Plant growth regulators, Metabolism, Physiological effects, mode of action of auxins, gibberellins, cytokinins, ethylene and ABA. Applications of these growth regulators in agriculture and horticulture.

Plant movements – A brief account on the classification and types of movements.

Photobiology – A brief account of dormancy, Photoperiodism, phytochrome and its role, Florigen concept, Vernalization.

Defence mechanisms – A brief account of Secondary metabolites (Phenolics, Flavonoids and alkaloids) and their role in plant defence.

PRACTICAL PAPER – VIII PLANT PHYSIOLOGY – III Total Units : 13

1. Separation of Photosynthetic pigments by paper chromatography and measurement of Rf Values. **1 unit**
 2. Determination of rate of photosynthesis at different wavelengths of light. **1 unit**
 3. Determination of rate of photosynthesis at different concentrations of CO₂ **1 unit**
 4. Estimation of Ascorbic acid content in a plant sample. **1 unit**
 5. Determination of RQ of carbohydrates, fats and proteins. **1 unit**
 6. Study of geotropism, phototropism and hydrotropism. **2 unit**
 7. Evolution of O₂ during photosynthesis. **1 unit**
 8. Evolution of CO₂ during respiration. **1 unit**
 9. Kuhne's fermentation vessel. **1 unit**
 10. Moll's half leaf Experiment. **1 unit**
 11. Evolution of heat during respiration **1 unit**
 12. Determination of the rate of growth using Arc Auxanometer **1 unit**
 13. An industrial visit to study the manufacture of alcohol / antibiotics / enzymes. **1 unit**
- Bioinformatics/ Molecular biological lab.

PRACTICAL QUESTION PAPER – VIII PLANT PHYSIOLOGY-III

Time: 3 hours

Max Marks: 35

1. Separate the photosynthetic pigments from sample **A** by paper chromatography and measure their Rf values. **8 marks**
2. Estimate the ascorbic acid content in the sample **B**. **8 marks**
3. Set up and comment on experiment **C**. **6 marks**
4. Identify and comment on physiological set up **D & E**. **2x2 ½ 5 marks**
5. Record and submission **5+3 = 8 marks**

SCHEME OF VALUATION

1. A. Requirement-**1** mark, principle- **2** marks, procedure and conducting the experiment- **3** marks, Rf values- **2** marks.
2. B. Requirements- **1** mark, principle- **2** marks, procedure and conducting the experiment- **3** marks, Result- **2** marks.
3. C. Identification-**1** mark, set up- **2** marks, comments-**2** marks, labelled Diagram-**1** mark
4. D. Identification-½ mark, comments-**1** mark, labelled diagram- **1** mark.E. Identification- ½ mark, comments-**1** mark, labelled diagram- **1** mark.
5. Record and Submission of field report (hand written field report only) **5+3=8** marks

LIST OF EXPERIMENTS FOR C.

- i. Evolution of O₂ during photosynthesis. ii. Evolution of CO₂ during respiration.
- iii. Moll's half leaf Experiment.
- iv. Evolution of heat during respiration (Thermos flask Experiment)

LIST OF EXPERIMENTS FOR D & E.

- i. Photosynthesis at different wavelengths of light
- ii. Photosynthesis at different concentrations of CO₂
- iii. Respirometer experiment for RQ
- iv. Kuhne's fermentation vessel v. Hydrotropism
- vi. Phototropism vii. Geotropism
- viii. Arc Auxanometer

REFERENCES

1. Buchanan, B.B, Gruissem, W. and Jones, R.L.2004. **Biochemistry and Molecular Biology of plants**. I.K.International Pvt. Ltd., New Delhi, <http://libgen.li/ads.php?md5=d1d78da5111831259143206d07197a34>
2. Dey and Harborne, J.B. (eds.) 1997. **Plant Biochemistry**. Academic press, New York. <http://libgen.li/ads.php?md5=356befbb80d5e8d9cdbc3e68c3c002d5>
3. Hall (1980), **Photosynthesis. 4 edition** Atlas publishers, New Delhi
4. Hall, D.O. and Rao, K.K. 1999 **Photosynthesis. 6 edition**, published in association with the Institute of Biology, Cambridge University Press. Cambridge, U.K. <http://libgen.li/ads.php?md5=abf676c66ff8e1db581836af96dd79e8>
5. Harborne, T.C 1981 **Phytochemical Methods: A guide to Modern Techniques of Plant Analysis**. Chapman and Hall, London. <http://libgen.li/ads.php?md5=c4e56d0c733851820b8c3d6a772ab1c4>
6. Hopkins, W.G. 1995. **Introduction to Plant Physiology**, John Wiley and Sons, New York. <http://libgen.li/ads.php?md5=8c5d52e2e46696cd6d9e12e0ff773533>
7. Moore, T.C. 1989. **Biochemistry and Physiology of Plant Hormones. 2 edition**, Springer-Verlag, New York, USA. <https://1lib.in/book/2139101/0877bc>
8. Moore, T.C.1974. **Research Experiences in Plant Physiology: A laboratory Manual**. Springer. Verlag, Berlin. <https://1lib.in/book/2137069/1fab51>

9. Muheyi, S and Ghosh, A.K. 2005 **Plant Physiology** New Central Book Agency (p) Ltd. 8/1 Chintamonu Das Lane, Kolkata 2009. India.
10. Plummer, D.T.1998. An Introduction to Practical **Biochemistry**. Tata McGraw-Hill Publishing Co. Ltd., New Delhi.
<http://libgen.li/ads.php?md5=6fc2a145bf0ceaf61ad6e2a128ca9e22>
<http://libgen.li/ads.php?md5=a6bd8951846c73a679f2a649578dba4f>
<http://libgen.li/ads.php?md5=3979777852289f41431e9117409b2624>
11. Purohit, S.S.2009 **Biochemistry-Fundamentals and Applications**. Gobies (India)
12. Salisbury and Ross. 2005. **Plant Physiology**, Thomson Wads Worth.
13. <http://libgen.li/ads.php?md5=db6d7a6ccde6ef834ed3795271c2d38c>
14. Singhal G.S., Renger G., Sopory S.K., Irrang K.D. &Govindjee 1999. Concepts in **Photobiology: Photosynthesis & Photomorphogenesis**. Narosa Pub. House, New Delhi. <http://libgen.li/ads.php?md5=e0f152a95b23a1e896b1d2b13ac362c4>
15. Stumpf, P.K. and Conn, E.E. (eds.) 1988. **The Biochemistry of Plants-** A Comprehensive treatise. Academic Press, New York.
<http://libgen.li/ads.php?md5=0d1e6e6cf8df33356aa563fc69c10f30>
<http://libgen.li/ads.php?md5=a5510bd32fb02a535b457041e4f29dc5>
<http://libgen.li/ads.php?md5=79ec061d96c907e7616459c7a9acb713>
16. Sunderajan, S. 1997. **College Botany Vol.III**, Himalaya Publications.
17. Taiz and Zeiger 2004. **Plant Physiology 3 edition**. Panima Publishing Corporation, New Delhi/Bangalore.
18. Taiz C and Zeiger E .1998 **Plant Physiology. 2 edition** Sinauer Associates, Inc, Publishers, Massachusetts, USA
19. Taiz.L. and Zeiger, E. 2003. **Plant Physiology. 3 edition**. Panima Publishing Corporation, New Delhi.
<http://libgen.li/ads.php?md5=04ce3c380ca9a8c5c73d37a428084480>
20. Thomas B. & Vince-Prue D. 1997. **Photoperiodism in plants. 2 edition**. Academic press, San Diego, USA.
<http://libgen.li/ads.php?md5=3bcd538b7e1459747e61a6a97bd1126b>
21. Wilkins,M.B.(eds). 1989. **Advanced plant physiology**. Pitman Publishing Ltd., London
22. Wilkins,M .B. 1998. **Advanced physiology**, ELBS, Longman
23. Wilson, K and Goulding, K.H. (eds.) 1986. **A Biologist Guide to Principles and Techniques of Practical Biochemistry**. Edward Arnold, London, UK.
24. <https://biology4isc.weebly.com/plant-movement.html>
25. <https://en.wikipedia.org/wiki/Phytochrome>
26. [https://bio.libretexts.org/Bookshelves/Introductory and General Biology/Book %3AGeneral Biology \(Boundless\)/30%3A Plant Form and Physiology/30.7%3A P lant Sensory Systems and Responses/30.7B%3A The Phytochrome System and Red Light Response](https://bio.libretexts.org/Bookshelves/Introductory_and_General_Biology/Book%3AGeneral_Biology_(Boundless)/30%3A_Plant_Form_and_Physiology/30.7%3A_Plant_Sensory_Systems_and_Responses/30.7B%3A_The_Phytochrome_System_and_Red_Light_Response)