

**Affiliated by Sant Gadge Baba Amravati University  
Amravati.**

**Department of Botany**

**B.Sc- II Year Sem- IV**

**(Effective from session 2014-15)**

- The examination in Botany of Fourth semester shall comprise of one theory paper, internal assessment and practical examination.
- Theory paper will be of 3 Hrs. duration and carry 80 marks.
- The internal assessment will carry 20 marks.
- The practical examination will be of 4 hours duration and carry 50 marks.
- Each theory paper has been divided into 6 units.
- There shall be one question in every unit with internal choice for each of 12 marks & one compulsory question covering all the syllabus of Semester-IV (8 marks).

**B.Sc. Part- II (Semester- IV)**

**Cell biology, Genetics and Biochemistry**

**Marks: 80**

**4S- BOTANY**

**Unit – I: Cell Biology**

- 1.1 Cell concept – Prokaryotic and Eukaryotic cell
- 1.2 Cell wall – Structure and Functions
- 1.3 Plasma membrane – Structure (models) and Functions
- 1.4 Nucleus – Ultra structure (nuclear membrane, nuclear pore complex and nucleolus) and functions
- 1.5 Chloroplast- Structure and Functions

**Unit–II: Cell Biology Structure and functions of-**

- 2.1 Endoplasmic Reticulum
- 2.2 Golgi complex
- 2.3 Vacuole
- 2.4 Ribosome
- 2.5 Peroxisome

- 2.6 Mitochondria
- 2.7 Cell cycle: Mitosis and Meiosis

## Unit – III Genetics

- 3.1 Chromosome- Morphology, Types, Centromere & Telomere
- 3.2 Chromosomal aberrations –
  - 3.2.1 Structural aberrations: Deletion, Duplication, Inversion and Translocation
  - 3.2.2 Numerical aberrations: Euploidy and aneuploidy

## Unit – IV Genetics

- 4.1 Mendelism: Mendel's law of Dominance, Segregations and Independent assortment, Incomplete dominance
- 4.2 Interaction of genes- Complimentary, Supplementary and Epistasis
- 4.3 Problems based on Mendelism and Interaction of Genes

## Unit – V Genetics

- 5.1 Linkage – Concept, Types and theories
- 5.2 Crossing over: Concept, Types and theories
- 5.3 Gene mutations- Spontaneous and Induced
- 5.4 Extra-nuclear Genome- Mitochondrial DNA and Chloroplast DNA

## Unit – VI Biochemistry

- 6.1 Nomenclature of Enzymes
- 6.2 Characteristics of Enzymes
- 6.3 Concept of holoenzymes, coenzymes and cofactors
- 6.4 Theories for Mechanism of action of Enzymes
- 6.5 Structure and functions Carbohydrates: Monosaccharides (Glucose), Disaccharides (Galactose) and Polysaccharides (Starch)

## PRACTICAL :

### I Cell Biology (Any Two)

- 1. Isolation of mitochondria from plants
- 2. Isolation of chloroplast
- 3. Squash preparation for the study of various stages of mitosis
- 4. Smear preparation for the study of various stages of meiosis.

### II Genetics

- 1. To prove Mendel's Monohybrid ratio.
- 2. To prove Mendel's Dihybrid ratio.
- 3. Problems based on Interaction of genes

### III Biochemistry

- 1. To study the enzyme activity of catalase.
- 2. To demonstrate test for glucose in grapes, & sucrose in cane sugar / beet root.
- 3. To demonstrate test for protein.
- 4. To demonstrate the lipid test in oily seeds.
- 5. To demonstrate the test for starch / cellulose.
- 6. To demonstrate the activity of enzyme amylase from germinating Wheat grains.

**B. Sc. II : Semester – IV Practical Schedule**

**Time : 4 hours**

**Marks : 50**

Q.1 :	Squash/Smear preparation for study Mitosis/Meiosis stages	10 Marks
Q.2 :	Genetics : To perform given experiment	10 Marks
Q.3 :	Genetics problem	05 Marks
Q.4 :	Biochemistry : To perform given test (Any Two)	10 Marks
Q.5 :	Spotting	05 Marks
Q.6 :	Class record and viva-voce	10 Marks

**Suggested Readings :**

1. **Ahluwalia K.B** 2005 (First Edition). Genetics. New Age International Private Ltd. Publishers, New Delhi.
2. **Buchanan B.B, Gruissem W. and Jones R.L** (2000). Biochemistry and Molecular Biology of Plants. American Society of Plant Physiologists Maryland, USA.
3. **Dalela & Verma** : Cytology.
4. **Darnell J.** 2000. Molecular Cell Biology (Fourth Edition). W.H. Freeman and Company, New USA.
5. **De-Robertis** EDP: Cell Biology.
6. **Devi P.** 2008-Principle and Methods of plant Molecular Biology, Biochemistry and Genetics Agrobios, Jodhpur, India.
7. **Gardner and Simmons Snustad** 2005 (Eighth Edition). Principles of Genetics, John Wiley and Sons, Singapore.
8. **Gerald Karp** 1999 Cell and Molecular Biology- Concept and Expts. John Wiley and Sons Inc., USA.
9. **Gupta P.K** (1995) Genetics and Cytogenetics. Rastogi Publications, Meerut.
10. **Leninger A.C** (1987). Principles of Biochemistry, CBS Publishers and Distributors (Indian Reprint)
11. **Lodish Etal** 2004 (Fifth Edition). Molecular Cell Biology, W H Freeman and company, New York.
12. **Moore T.C.** 1989. Biochemistry and Physiology of Plant Hormones Springer – Verlag, New York, USA.
13. **P.S. Verma & Agrawal V.K.** : T.B. of Cytology.
14. **Pawar C.B** 2003 (First Edition). Genetics Vol. I and II. Himalaya Publishing House, Mumbai.
15. **Powar C.B** 2005 (Third Edition). Cell Biology, Himalaya Publishing, Mumbai.
16. **Roy S.C and KK De** 2005 (Second Edition). Cell Biology, New central Book Agency Private Ltd., Kolkata.
17. **Sharma J.R** 1994 Principles and practices of Plant Breeding. Tata McGraw-Hill
18. **Shrivastav H.N.** - Cell Biology and Genetics - New Millennium Edition - Pradip's.
19. **Singh B.D** 2004. Genetics. Kalyani Publication, Ludhiana.
20. **Strickberger** 2005. (Third Edition). Genetics. Prentice Hall of India Pvt. Ltd., New Delhi.
21. **Veerbala Rastogi** : Introduction to cytology.
22. **Verma P.S and Agarwal V.K** 2006 Cell Biology, Genetics, Molecular Biology, Evolution, Ecology. S.Chand and Company, New Delhi.

23. **Verma P.S. and Agarwal V.K.**(1991), Genetics. S Chand Comp.Ltd. Ramnagar, New Delhi.
24. **Verma S.K. and Mohit Verma** 2007. A.T.B of Plant Physiology, Biochemistry and Biotechnology, S.Chand Publications.
25. **Verma S.K. and Verma Mohit** (2007). A.T.B of Plant Physiology, Biochemistry and Biotechnology, S.Chand Publications.
26. **Modern Practical Botany**, Volume-I, Dr.B.P.Pande, S.ChandPublication, New Delhi.
27. **Modern Practical Botany**, Volume-II, Dr.B.P.Pande, S.ChandPublication, New Delhi.
28. **Modern Practical Botany**, Volume-III, Dr.B.P.Pande, S.ChandPublication, New Delhi.



**UNIT II- Angiosperm Systematics**

- 2.1 Systems of Classification: Bentham and Hooker's System, Engler and Prantle's system.
- 2.2 Systematic studies & economic importance of following Families  
Dicotyledons (Polypetalae): Malvaceae, Brassicaceae, Leguminosae, Apiaceae,

**UNIT III- Angiosperm Systematics**

- 3.1 Systematic studies & economic importance of following Families  
Dicotyledons (Gamopetalae): Asteraceae, Asclepiadaceae, Apocynaceae, Solanaceae, Verbenaceae, Lamiaceae.
- 3.2 Dicotyledons ( Monoclamydeae): Euphorbiaceae.
- 3.3 Monocotyledons: Liliaceae, Poaceae.

**UNIT IV- Anatomy**

- 4.1 Types of Tissues:  
Meristematic – Types of meristems Permanent – Simple and complex.
- 4.2 Characteristics of growth rings, Sapwood and heartwood.
- 4.3 Anatomy of root: Primary structure in dicot and monocot root, normal secondary growth in dicot root.

**UNIT V- Anatomy**

- 5.1 Anatomy of stem: Primary structure in monocot and dicot stem, normal secondary growth in dicot stem.
- 5.2 Anomalies in primary structure in *Boerhavia* stem, secondary structure in *Bignonia* and *Dracaena* stem.
- 5.3 Leaf Anatomy: Internal structure in *Nerium* and *Maize* leaf.

**UNIT VI- Embryology**

- 5.1 Microsporangium, microsporogenesis, development of male gametophyte.
- 5.2 Megasporangium, types of ovules, megasporogenesis, development of female gametophyte (monosporic, Bisporic & tetrasporic).
- 5.3 Double fertilization and triple fusion.
- 5.4 Embryo – Classification of embryo.
- 5.5 Endosperm types & significance, Suspended animation

**Laboratory Exercises**

- 1) Embryology of Angiosperms:
  - i) Observation of wide range of flowers available in the locality and methods of their pollination.
  - ii) Study through permanent slides of T.S. of anthers, microsporogenesis, L.S. of ovule, types of endosperms and embryo of *Capsella*.
  - iii) Mounting of T.S. of anthers, Pollen grains and pollinia.
- 2) Anatomy of angiosperms : Preparation of double stained slides of root, stem and leaves of angiosperms mentioned in the syllabus.
- 3) Taxonomy : Description of ten plants belonging to different families in technical language and identification upto family level.

## Shri Pundlik Maharaj Mahavidyalaya Nandura Dist Buldana

---

- 4) Long and short excursion is essential

**Note :** Field tour reports should be supported by exhaustive field notes and photographic representation of plant species studied

**Brassicaceae-** *Brassica*, **Malvaceae-** *Hibiscus*, *Sida*, *Malvastrum*, **Fabaceae-** *Crotalaria*, *Indigifera*, *Tephrosia*, **Caesalpinoidae-** *Caesalpineia*, *Cassia*, **Mimosoidae-** *Prosopis*, *Acasia*, **Apiaceae-** *Corindrum*,  
**Apocynaceae-** *Vinca*, *Thevetia*, **Asclepiadaceae-** *Cryptostegia*, *Calatropis*,  
**Solanaceae-** *Datura*, *Solanum*, *Withania*, **Euphorbiaceae-** *Croton*, *Jatropha*, *Euphorbia*, ,  
**Lamiaceae-** *Oscimum*, *Hyptis*, **Asteraceae-** *Tridax*, *Lagasca* **Verbanaceae** – *Lantana*, *Clerodendron*

### PRACTICAL EXAMINATION

**Time;- 5 Hours**

**Max. Marks- 50**

- |     |   |          |
|-----|---|----------|
| Q.1 | Preparation of double stained permanent micropreparation of given angiospermic Material<br>Identification with reasons        | 10 Marks |
| Q.2 | Description of given angiospermic plant in technical language, identification up to family,<br>floral formula, floral diagram | 20 Marks |
| Q.3 | Spotting (taxonomy-1, anatomy-2, Embryology-2)  | 10 Marks |
| Q.4 | Class record, Excursion report with plant photographic submission   | 06 Marks |
| Q.5 | Submission of micropreparation and viva voce  | 04 Marks |

**Books Recommended :**

- 1) **A.C.Dutta** : Text Book of Botany.
- 2) **Andrews A.N.** : Studies in Paleobotany.
- 3) **Arnold C.A.** : Introduction of Paleobotany.
- 4) **Bhojwani & Bhatnagar** : Embryology of Angiosperms.
- 5) **Chandurkar** : Plant Anatomy
- 6) **Cutter E.G.**, 1971 : Plant Anatomy Experiment and Interpretation Part-II, Organs, Edward Arnold, London.
- 7) **Davis P.H.**, and Heywood V.H., 1993 : Principles of Angiosperm Taxonomy : Oliver and Boyd, London.
- 8) **Eames E.J.** : Morphology of vascular Plants. edition, prentice Hall of India Pvt.Ltd. New Delhi.
- 9) **Esau K.** : 1977, Anatomy of seed plant, 2nd Edition, John Wiley and Sons, New York.
- 10) **Gangulee & Kar** : College Botany Vol.II
- 11) **Gangulee Das and Dutta** : College Botany, Vol.I
- 12) **Gifford E.M. and Foster A.S.**, 1988 : Morphology and Evolution of Vascular Plants, W.H. Freeman & Company, New York.
- 13) **Hartmann H.T. and Kestler D.E.**, 1976 : Plant Propagation Principles and practices, 3rd
- 14) **Heywood V.H. and Moore D.M.** (Eds) 1984 : Current concepts in plant Taxonomy. Academic Press, London.
- 15) **Jeffrey C.**, 1982 : An introduction to Plant Taxonomy, Cambridge University Press, Cambridge, London.
- 16) **Maheshwari P.** : Introduction of Embryology of Angiosperms.
- 17) **Pande B.P.** : A Text Book of Angiosperms.
- 18) **Radford A.E.**, 1986 : Fundamentals of Plant Systematics, Harper and Row, New York.
- 19) **Rendle A.B.** : Classification of flowering plants, Vol.I & Vol.II.
- 20) **S.Sundar Rajan** : College Botany, Vol.II & Vol.III.
- 21) **Shukla & Mishra** : Paleobotany.
- 22) **Singh and Jain** : Plant Anatomy.
- 23) **Singh and Jain** : Taxonomy of Angiosperms.
- 24) **Singh, 4.** 1999, Plant Systematics - Theory and Practices, Oxford and IBH Pvt. Ltd., New Delhi.
- 25) **Stace C.A.**, 1989. : Plant Taxonomy and Biosystematics (2nd Edition) Edward Arnold, London.
- 26) **Stewart W.N.**, 1983 : Paleobotany and Evolution of Plants, Cambridge University Press, Cambridge. **Cutter, E.G.** 1969 : Part-I, Cells and tissues, Edward, Arnold, London.
- 27) **Trivedi B.S. & Sharma B.B.** : Introductory Taxonomy.
- 28) **Tyagi & Kshetrapal** : Taxonomy of Angiosperms.
- 29) **Vasistha P.C.** : Plant Anatomy.
- 30) **Vasistha P.C.** : Taxonomy of Angiosperms.
- 31) **Walton** : An Introduction & Study of fossil.
- 32) Modern Practical Botany, Volume-I, Dr.B.P.Pande, S.Chand Publication, New Delhi.
- 33) Modern Practical Botany, Volume-II, Dr.B.P.Pande, S.Chand Publication, New Delhi.
- 34) Modern Practical Botany, Volume-III, Dr.B.P.Pande, S.Chand Publication, New Delhi.

