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**GONDWANA UNIVERSITY  
GADCHIROLI**



**FACULTY OF SCIENCE AND  
TECHNOLOGY**

**SYLLABUS**

**For**

T. Y. B. Sc.

**BOTANY**

**SEMESTER – V & VI**

**Under**

**Choice Based Credit System (CBCS)**

(With effect from: 2019-20)

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# GONDWANA UNIVERSITY, GADCHIROLI

## CHOICE BASED CREDIT SYSTEM

T. Y. B.Sc.

BOTANY

(SEMESTER V and VI)

(With effect from academic session 2019-20)

- There shall be Two Semesters in B. Sc. Part III. Each Semester comprise of Two Theory papers, practical and internal assessment.
- The syllabus is based on six theory periods and six practical periods per week.
- Each theory paper divided into four units.
- **Scheme of Examination:** The performance shall be evaluated into two parts viz. by Internal Assessment (college assessment) in the first part & by conducting the Semester End Examinations (conducted by university) in the second part.
- **Internal Assessment:** Based on Assignment, Seminar, Unit Test & Overall Attendance and Performance of the student
- **Semester End Assessment:** It is based on the Performance in the semester end Theory/ Written/ Practical examination.
- **The Semester End Examination for BOTANY course will be as follows:**
  - External assessment- University Examination : 50 marks each paper : Total 100 marks
  - Internal assessment- College Assessment : 10 marks each paper : Total 20 marks  
**(External assessment + Internal assessment = Total - 120 Marks for theory)**
  - One Practical Course: 30 marks (For any two selected from DSE)
  - The practical course will be concerning with the DSE theory papers.
- **Skill Enhancement Course (SEC):** The students have to choose one Skill Enhancement Course from the pool given.
- Marks distribution for SEC: Theory- 30 marks, Exercise/Practical-70 Marks
- Assessment of Skill Enhancement Course shall be done at college level.
- The marks will be given for all examinations and they will be converted into grade points. The final grade card will have marks, credits, grades, grade points, SGPA & CGPA.

**Scheme for Choice Based Credit System for B.Sc. Programme in**  
**BOTANY**

Semester	Core Course 6 Credits	Ability Enhancement Compulsory Course (2+2= 4 credits)	Skill Enhancement Courses SEC 2 Credits	Discipline Specific Elective DSE 6 Credits
<b>SEM-V</b>			<p><b>SEC-III</b></p> <p><u>Any One SEC</u> is to be chosen from the pool of SEC of Core Subjects selected by the student</p> <ol style="list-style-type: none"> <li><b>1. Gardener Training – (Basic)</b></li> <li><b>2. Mushroom Culture Technology</b></li> <li><b>3. Herbal Technology</b></li> <li><b>4. High Density Planting</b></li> <li><b>5. Floriculture</b></li> </ol> <p><b>PRACTICAL</b> (70% part of the SEC is Practical)</p>	<p><b>DSE I</b></p> <p><u>Two papers of any one DSE</u> are to be chosen by the student from Three Options given below.</p> <p><b>Option-1</b> <b>Paper-I :</b> Genetics and Plant Breeding – I</p> <p><b>Paper II:</b> Genetics and Plant Breeding - II</p> <p><b>Option-2</b> <b>Paper-I:</b> Molecular Biology - I</p> <p><b>Paper II:</b> Molecular Biology - II</p> <p><b>Option-3</b> <b>Paper-I:</b> Economic Botany- I</p> <p><b>Paper II:</b> Economic Botany- II</p> <p><b>PRACTICAL</b></p> <p>Based on paper I and II of DSE selected by the student from the above mentioned Options-1, 2 and 3 of Semester-V.</p>

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## SEMESTER – V:

### Discipline Specific Elective-I (DSE-I)

**NOTE: Student has to select any ONE from the three Options under DSE-I category.**

Papers	Title of the Paper	Theory / Practical	Internal Assessment	Total Marks
<b>Option-1</b>				
Paper – I	Genetics and Plant Breeding – I	50 Marks	10 Marks	60 Marks
Paper - II	Genetics and Plant Breeding – II	50 Marks	10 Marks	60 Marks
<b>Option-2</b>				
Paper – I	Molecular Biology - I	50 Marks	10 Marks	60 Marks
Paper -II	Molecular Biology - II	50 Marks	10 Marks	60 Marks
<b>Option-3</b>				
Paper –I	Economic Botany- I	50 Marks	10 Marks	60 Marks
Paper –II	Economic Botany- II	50 Marks	10 Marks	60 Marks
<b>Practical – V</b>	Based on two papers of DSE – I selected by the student from the above mentioned Options- 1, 2 and 3 of Semester –V	30 Marks	--	30 Marks
<b>Internal Assessment:</b> Based on Assignment, Seminar, Unit Test & Overall Attendance and Performance of the Student.				

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**GONDWANA UNIVERSITY, GADCHIROLI**

**CBCS Theory Question Paper Pattern**

**For**

**B.Sc. BOTANY**

**SEMESTER – V and VI**

**Theory**

**All questions are compulsory and carry equal marks**

**Draw well labeled diagram where ever necessary**

**[Time 3 Hours]**

**[Max. Marks – 50]**

**Question 1.** Based on Unit – I

**05 x 2 = 10**

a. Unit - I

b. Unit - I

**OR**

**02½ x 4 = 10**

c. Unit - I

d. Unit - I

e. Unit - I

f. Unit - I

**Question 2.** Based on Unit – II

**05 x 2 = 10**

a. Unit II

b. Unit II

**OR**

**02½ x 4 = 10**

c. Unit II

d. Unit II

e. Unit II

f. Unit II

**Question 3.** Based on Unit – III

**05 x 2 = 10**

a. Unit III

b. Unit III

**OR**

**02½ x 4 = 10**

c. Unit III

d. Unit III

e. Unit III

f. Unit III

**Question 4.** Based on Unit – IV

**05 x 2 = 10**

a. Unit III

b. Unit III

**OR**

**02½ x 4 = 10**

c. Unit IV

d. Unit IV

e. Unit IV

f. Unit IV

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**Question 5.** Write any ten questions in one or two lines only  
(Diagrams are NOT necessary)

**1 x 10 = 10**

- a. Unit I
- b. Unit I
- c. Unit I
- d. Unit II
- e. Unit II
- f. Unit II
- g. Unit III
- h. Unit III
- i. Unit III
- j. Unit IV
- k. Unit IV
- l. Unit IV

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## Option-1

**B. Sc.**  
**Semester V**  
**Discipline Specific Elective-I (DSE-I)**  
**Paper-I**  
**Genetics and Plant Breeding - I**  
**(48 Periods)**

**Unit - I** 12 Periods

1. Brief History of Mendel, Terminology of genetics, Mendel's laws of Inheritance
2. Non-Mendelian Inheritance: Lethal gene (2:1); Co-dominance (1:2:1), Dominant epistasis (12:3:1), Recessive epistasis (13:3); Inhibitory gene (15:1); Polymeric gene (9:6:1).
3. Multiple allelism and Pleotropism.

**Unit - II** 12 Periods

1. Cytoplasmic Inheritance: Leaf variegation in *Mirabilis jalapa*, Mutations in mitochondrial DNA cause human disorders, Kappa particles in *Paramecium*, maternal effect.
2. Chromosome theory of inheritance.
3. Genetic maps: Construction of genetic maps with 2-point and 3- point test cross data.
4. Sex determination and sex-linked inheritance: Sex determination in *Drosophila*, humans and plants, Klinefelter and Turner's syndrome, Barr bodies, Lyon's hypothesis.

**Unit - III** 12 Periods

1. Plant Breeding: Introduction and objectives
2. Modes of reproduction in crop plants with suitable examples,
3. Important achievements and undesirable consequences of plant breeding.
4. Crop improvement: Centers of origin and domestication of crop plants.

**Unit - IV** 12 Periods

1. Plant genetic resources, acclimatization
2. Plant Introduction: Procedure of plant introduction –quarantine- cataloguing- evaluation – multiplication, distribution – acclimatization, purpose of plant introduction, achievements, merits and demerits.
3. Selection & breeding methods - for self-pollinated crops (Population improvement, mass selection, recurrent selection); for cross pollinated crops (pedigree & mass selection, bulk & back cross) and vegetatively propagated plants (clonal selection).
4. Hybridization: history, objectives, types, procedure (Emasculation methods, bagging, tagging, pollination, harvesting and storing of F1 seeds, selfing), techniques and consequences, advantages and limitations.

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## Laboratory Exercises:

Use Photographs / transparencies / permanent slides / charts

1. Mendel's laws using seed / plastic beads and applying chi-square.
2. Chromosome mapping using point test cross data.
3. Problems related to Lethal Genes, Co-dominance, and epistasis gene interaction  
(12:3:1; 13:3; 15:1; 9:6:1)
4. Sex determination in plants, *Drosophila* and humans
5. Photographs showing sex linked inheritance
6. Chloroplast variation in Four O'clock plant
7. Plant Propagation techniques – Vegetative (Layering/ Grafting/ Budding)
8. Hybridization techniques: Emasculation – types, Bagging and tagging
9. Pollen viability test - *In vitro* a. Brewbaker's medium preparation  
b. Staining test in acetocarmine  
*In vivo* – Pollen Germination on stigma (through style; through ovule)
10. Systematic description and artificial hybridization of locally available crop plants.
11. Identification of important varieties of locally available crops\* - Cereals (Wheat, Rice); millets (Sorghum); Pulses (Gram, Pea); Oil seeds (Mustard, Ground nut & Sunflower); Fiber (Cotton).

\* **Note:** Center of origin, habit and its utility (parts used) should be taught.

1. Frequent Industrial / Laboratory visits are necessary
2. Submit Industrial / Laboratory visit report duly signed by HOD.

## Suggested Readings:

1. **Backcock., E.B. (2001).** *Genetics and Plant breeding*. Agrobios (India), Jodhpur
2. **Gardner, E.J., Simmons, M.J., Snustad, D.P. (2008):** *Principles of Genetics*. VIII Edition. Wiley India.
3. **Griffiths, A.J.F., Wessler, S.R., Lewontin, R.C. and Carroll, S.B.** *Introduction to Genetic Analysis*. IX Edition. W. H. Freeman and Co.
4. **Gupta P.K.,** 'Genetics'. Rastogi Publications.
5. **James D. Watson, Nancy H. Hopkins. (1987):** 'Molecular Biology of the Gene'. IV Edition,

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Benjamin Cummings Publications.

6. **Klug, W.S., Cummings, M.R., Spencer, C.A. (2012):** *Concepts of Genetics*. X Edition. Benjamin Cummings Publications.
7. **Pandey, S.N. (2017):** *Principles of Genetics*, Ane books publisher.
8. **Pierce, B.A. (2011):** *Genetics: A conceptual Approach*, IV Edition. Macmillan Higher Education Learning.
9. **Russell, P. J. (2016):** *iGenetics- A Molecular Approach*. III Edition. Benjamin Cummings Publications.
10. **Singh, B.D. (2009):** *Genetics*: Kalyani Publications.
11. **Snustad, D.P. and Simmons, M.J. (2010):** *Principles of Genetics*. V Edition. John Wiley & Sons Inc., India.
12. **Srtickberger, M.W. (1990):** *Genetics* (3rd Edition) . Macmillan Publishing company.
13. **Verma, P.S. and Agarwal, V.K. (2010) :** *Genetics*. S.Chand.
14. **Kumar, N (2017):** *Introduction To Horticulture* . 7<sup>th</sup> Ed. Oxford & IBH publ.
15. **Singh, B.D. (2009):** *Plant Breeding Principles and methods*: Kalyani Publications.
16. **Kaloo, G, and J.B.ChoudharyEds. (1992):** Distant hybridization of crop plants.
17. **Vaidya A.V., K. Mallikarjunarao (2018):** *Heterosis Breeding*
18. **Chaudhari, H.K. (1984).** *Elementary Principles of Plant Breeding*.Oxford – IBH. 2<sup>nd</sup> edition.
19. **Acquaah, G. (2007).** *Principles of Plant Genetics & Breeding*.Blackwell Publishing.
20. **Allard, R.W.(1960) .** *Principles of Plant Breeding*.John Wiley & Sons.Inc. New York.
21. **Briggs,F.N& Knowles, P.F (1967) .** *Introduction to Plant Breeding*. Reinhold Publ. Co., New York/ Amsterdam/ London.
22. **Chopra,V. L. (2000).** *Plant Breeding. Theory and Practicals* (2<sup>nd</sup> edition), Oxford & IBH Publ. Co. Pvt.. Ltd., New Delhi.
23. **Jain H.K. &Kharkwal, M.C..(Eds.) (2004).***PlantBreeding: MendeliantoMolecular Approaches*.Narosa Publishing. House, New Delhi, Chennai, Mumbai, Calcutta.
24. **Russel, G.E. (1985).** *Progress in Plant Breeding* In Russel G E (Ed.) Butter Worth & Co. Publ. Ltd., Calcutta.
25. **Sharma, J R. (1994).** *Principles and Practice of Plant Breeding*, Tata-McGraw- Hill Publ. Co. Ltd, New Delhi.

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**B. Sc.**  
**Semester V**  
**Discipline Specific Elective-I (DSE-I)**  
**Paper-II**  
**Genetics and Plant Breeding - II**  
**(48 Periods)**

**Unit - I**

**12 Periods**

1. **Gene organization:** Structure of Gene, Modern concept of Gene.
2. **RNA:** Types and function –mRNA, tRNA, rRNA, snRNA, snoRNA, miRNA, siRNA, antisense RNA.
3. **Genetic code:** Salient features, Exceptions, Wobble-hypothesis, Method of replication of DNA in Eukaryotes.
4. **Population Genetics:** Gene pool, Gene frequency, Hardy-Weinberg Law.
5. **Pedigree analysis:** Concept, symbols and sign. Study of traits (Autosomal dominant, autosomal recessive, X-linked and Y- linked)

**Unit - II**

**12 Periods**

1. **Chromosome organization:** Morphology and Structure of Chromosome.
2. **Karyotype:** Karyotype variations such as changes in chromosome number, Structural alterations, Centromere position.
3. **Special types of chromosomes** - Lampbrush, Polytene and B- chromosomes.
4. Chromosome mapping, Chromosome banding technique.

**Unit - III**

**12 Periods**

1. **Inbreeding and Heterosis:** History, Genetic basis of inbreeding depression and heterosis, applications.
2. **Quantitative Inheritance:** Concept, mechanism and examples. Monogenic and polygenic inheritance.
3. **Concept of Germplasm:** Germplasm conservation- *In situ* seed banks, plant banks, shoot tip banks, cell and organ banks, and DNA banks.

**Unit - IV**

**12 Periods**

1. **Plant breeding and crop improvement:** methods of crop improvement – polyploidy breeding (Production of autopolyploids: materials and agents used method of treatment- merits and demerits-achievements), mutational breeding (mechanism of action of radiations, mechanism of action of chemical mutagens, procedure of mutation breeding, recurrent irradiation, gamma garden, directed mutagenesis, application of mutation breeding, limitations and achievements).
2. **Distant Hybridization:** concept, importance, types and applications, achievements and Limitations (barriers in production of distant hybrids-failure of zygote formation-failure of

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zygote development lethal genes-phenotypic disharmony between two parental genomes-chromosome elimination- incompatible cytoplasm – endosperm abortion-failure of hybrid seedling development).

3. **Role of biotechnology in crop improvement:** Genetic transformation of plants, Transgenic techniques, Steps for developing new crop varieties, Bacteria and gene transfer in plants, vector mediated gene transfer, Resistance to biotic stresses, Insect resistance, Virus resistance, Disease resistance, Pest resistant plants (Bt-cotton); herbicide resistance; disease and stress resistant plants; transgenic crops with improved quality traits (Flavr savr Tomatoes, Golden rice)

### Laboratory Exercises:

Use Photographs / transparencies / permanent slides / charts

1. Study of RNA types
2. Study and analysis of human, Onion or any plant karyotype (normal and abnormal) and Identification of genetic disorder.
3. Study of special types of chromosomes.
4. Heterosis breeding and test in maize, Sorghum
5. Mutation breeding – Capsicum seeds treated with chemicals (drawings of control and treated seedlings showing morphological variations.
6. Pictures of mutant varieties of Cotton, Sunflower
7. Monogenic inheritance problems - like to calculate allele frequency in a given population.  
(See link-1 and 2)
8. Polygenic inheritance problems (See link-3)
9. Evolutionary chart of polyploids – Wheat (*Triticum aestivum* and *Triticale*)
10. Study of steps of genetic engineering techniques from photographs (Bt cotton, Golden rice, Flavr savr tomatoes)
11. Germplasm collection of locally available varieties of cereals, Pulses, vegetables, flowers and fruits.

### Practical-Links:

1. <https://wiki.groenkennisnet.nl/display/TAB/Chapter+7.1+Calculation+of+allele+frequencies>
2. <https://www.ncbi.nlm.nih.gov/books/NBK22056/>
3. <http://www.bifidosoft.com/en/tutorials/genetics/how-to-solve-polygenic-inheritance-problems.html>

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1. Frequent Industrial / Laboratory visits are necessary
  2. Submit Industrial / Laboratory visit report duly signed by HOD.
  - \*3. Germplasm (seeds only) collected by the students be submitted
- \* **Note:** Students should be motivated to submit germplasm (seeds only) of Not less than 10 varieties and not more than 15 varieties. Few seeds collected in small polyethylene or self-sealing bag / cover pasted or stapled on chart paper (A4 size) can be submitted at the time of practical examination.

### **Suggested Readings:**

1. **Backcock, E.B. (2001).** *Genetics and Plant breeding*. Agrobios (India), Jodhpur
2. **Gardner, E.J., Simmons, M.J., Snustad, D.P. (2008):** *Principles of Genetics*. VIII Edition. Wiley India.
3. **Griffiths, A.J.F., Wessler, S.R., Lewontin, R.C. and Carroll, S.B.** *Introduction to Genetic Analysis*. IX Edition. W. H. Freeman and Co.
4. **Gupta P.K., 'Genetics'**. Rastogi Publications.
5. **James D. Watson, Nancy H. Hopkins. (1987):** *'Molecular Biology of the Gene'*. IV (Ed.) Benjamin Cummings Publications.
6. **Klug, W.S., Cummings, M.R., Spencer, C.A. (2012):** *Concepts of Genetics*. X Edition. Benjamin Cummings Publications.
7. **Pandey, S.N. (2017):** *Principles of Genetics*, Ane books publisher.
8. **Pierce, B.A. (2011):** *Genetics: A conceptual Approach*, IV Edition. Macmillan Higher Education Learning.
9. **Russell, P. J. (2016):** *Genetics- A Molecular Approach*. III (Ed.) Benjamin Cummings Publications.
10. **Singh, B.D. (2009):** *Genetics*: Kalyani Publications.
11. **Snustad, D.P. and Simmons, M.J. (2010):** *Principles of Genetics*. V Edition. John Wiley & Sons Inc., India.
12. **Srtickberger, M.W. (1990):** *Genetics* (3rd Ed.) . Macmillan Publishing Company.
13. **Verma, P.S. and Agarwal, V.K. (2010) :** *Genetics*. S.Chand.
14. **Kumar, N (2017):** *Introduction To Horticulture* . 7<sup>th</sup> Ed. Oxford & IBH publ.
15. **Singh, B.D. (2009):** *Plant Breeding Principles and methods*: Kalyani Publications.

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16. Kaloo, G, and J.B.ChoudharyEds. (1992): Distant hybridization of crop plants.
  17. Vaidya A.V., K.Mallikarjunarao ( 2018): *Heterosis Breeding*
  18. Chaudhari, H.K. (1984). *Elementary Principles of Plant Breeding*.Oxford – IBH. 2<sup>nd</sup>Ed.
  19. Acquaah, G. (2007). *Principles of Plant Genetics & Breeding*.Blackwell Publishing.
  20. Allard, R.W.(1960). *Principles of Plant Breeding*.John Wiley & Sons.Inc.New York.
  21. Basra, A.S. (2000). *Heterosis and Hybrid Seed Production in Agronomic Crops* . In Basra, A.S.(Ed.). M.S. Swaminathan Research Foundation,Taraman Industrial Area Chennai.
  22. Briggs,F.N& Knowles, P.F (1967). *Introduction to Plant Breeding* . ReinholdPubl. Co., New York/ Amsterdam/ London.
  23. Chopra,V. L. (2000). *Plant Breeding. Theory and Practicals* (2<sup>nd</sup>edition),Oxford & IBH Publ. Co. Pvt.. Ltd., New Delhi.
  24. Jain H.K. &Kharkwal, M.C..(Eds.) (2004).*PlantBreeding: MendeliantoMolecular Approaches*.Narosa Publishing. House, New Delhi, Chennai,Mumbai, Calcutta.
  25. Russel, G.E. (1985). *Progress in Plant Breeding* In Russel, G.E. (Ed.) Butter Worth & Co. Publ. Ltd., Calcutta.
  26. Sharma, J R. (1994). *Principles and Practice of Plant Breeding*, Tata-McGraw-Hill Publ. Co. Ltd, New Delhi.
  27. Sen, S. &Kar, D.K. (2005). *Cytology and Genetics*.B. M. Johri (Ed.)Narosa Publishing House, New Delhi.
  28. Sharma, A. & Sharma, A. (1999). *Plant Chromosomes*.HardwoodAcademic Publishers. Australia.
  29. Sharma, A. & Sen, S. (2002). *Chromosome Botany*.Oxford and IBHPublishing Co. Pvt. Ltd. New Delhi.
  30. Singh, R. J.(1993) . *Plant Cytogenetics*.CRC Press Inc. Boca Raton. London.
  31. Swanson, C.P, Merg, T. &Yarng, W.J. (1988). *Cytogenetics* (2nd edition),Prentice Hall, New York
  32. Balasubramanian, D(1993).*Genes and Means*. CSIR, New Delhi
  33. Brown, T. A. (1992). *Genetics: A molecular Approach* . Chapman & Hall,London.
  34. Chawla, H.S. (2000). *Introduction to Plant Biotechnology*. Oxford & IBHPubl. Co. New Delhi
  35. Gupta, P.K. (2010). *Elements of Biotechnology*.Rastogi Publishers, Meerut
  36. Slater, A., Scott, N.W. & Fowler, M.R. (2008). *Plant Biotechnology: The Genetic Manipulation of Plants*, Oxford University Press.

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## Option-2

**B. Sc.**  
**Semester V**  
**Discipline Specific Elective-I (DSE-I)**  
**Paper-I**  
**Molecular Biology - I**  
**(48 Periods)**

**Unit - I:**

**Nucleic acids: Carriers of genetic information (12 Periods)**

Nucleic Acid discovery, chemical nature and types; Nucleic Acid as the carrier of genetic information (Griffith's, Hershey & Chase, Avery, McLeod & McCarty, Fraenkel - Conrat's experiments).

**Unit – II:**

**Structures of DNA and RNA / Genetic Material (12Periods) DNA**

Structure: Watson and Crick - historic perspective, structure, salient features of double helix, types of DNA (A, B, C, D, Z, Single stranded and Circular DNA), denaturation and renaturation (cot curves).

RNA structure and types (hnRNA, mRNA, rRNA, tRNA, snRNA, miRNA, siRNA, snoRNA).

**Unit - III:**

**(12 Periods)**

**Organization of DNA**

Prokaryotic DNA (chromosomal and plasmid DNA), viral DNA (single stranded and double stranded DNA), eukaryotic DNA (chromatin, nucleosome, chromosome, heterochromatin and euchromatin).

**Unit – IV:**

**(12 Periods)**

**Replication of DNA**

Definition and proposed methods of DNA replication (conservative, semi-conservative and discontinuous replication), Models of DNA replication (rolling circle, theta replication and replication of ds linear DNA), chemistry of DNA synthesis (Kornberg's discovery), Enzymes involved in DNA replication, mechanism of replication of linear chromosome.

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### Laboratory Exercises:

1. To study structure of DNA double helix using model/chart/photograph/ppt/video.
2. To study structures of different types of DNA using models /charts / photographs /ppt / video.
3. To isolate plant DNA and its quantification by spectrophotometric method.
4. To estimate DNA content by Diphenyl amine reagent method.
5. To isolate and quantify bacterial chromosomal DNA.
6. To isolate and quantify Plasmid DNA.
7. To study organization of eukaryotic chromatin using model /chart /photograph /ppt / video.
8. To study DNA replication mechanisms (Rolling circle, Theta replication and semi-conservative replication) through models/charts/photographs/ppt/video.

### Suggested Readings:

1. **Cell and Molecular Biology (Eighth Edition):** E. D. R. De Robertis and E. M. R. De Robertis, Jr.
2. **Biochemistry and Molecular Biology of Plants (Second Edition):** Bob B. Buchanan, Wilhelm Gruissem and Russell L. Jones.
3. **Cell and Molecular Biology Concepts and Experiments (Second Edition):** Gerald Karp.
4. **Biochemical Methods (Second Edition):**Sadasivam and Manikkam.
5. **Molecular Cell Biology:** C. B. Powar.
6. Buchanan, B. B., Gruissem, W. and Jones, R.L. 1989. **Biochemistry and Molecular Biology of plants**, American Society of Plant Physiologists, Maryland, USA.
7. **College Botany (Plant Physiology & Molecular Biology) Volume Four:** S. Sundara Rajan, Himalaya Publication House.

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**B. Sc.**  
**Semester V**  
**Discipline Specific Elective-I (DSE-I)**  
**Paper-II**  
**Molecular Biology - II**  
**(48 Periods)**

**Unit - I:** **(12 Periods)**

**Central dogma and Genetic Code**

Key experiments establishing the central dogma (adaptor hypothesis and discovery of mRNA template), Central dogma reverse (exception to central dogma), Genetic code and its salient features.

**Unit – II:**

**Transcription** **(12 Periods)**

Transcription in prokaryotes and eukaryotes (RNA polymerases, transcription factors, promoter, initiation, elongation and termination). Principles of transcriptional regulation in prokaryotes (Lactose and Tryptophan operons) and eukaryotes (transcription factors, heat shock proteins, steroids and peptide hormones and gene silencing). Inhibitors of transcription.

**Unit – III:** **(12 Periods)**

**Processing and Modification of RNA**

Split genes-concept of introns and exons, removal of introns, spliceosome machinery, splicing pathways, group I and group II intron splicing, alternative splicing, eukaryotic mRNA processing (5' cap, 3' poly A tail).

**Unit – IV:**

**Translation** **(12 Periods)**

Ribosome structure and assembly, mRNA; charging of tRNA, aminoacyl tRNA synthetases; various steps in protein synthesis in prokaryotes and eukaryotes (Initiation, elongation and termination)

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### **Laboratory Exercises:**

1. To study structure of different types of RNA using models / charts / photographs /ppt / videos.
2. To isolate plant RNA and its quantification by Orcein method.
3. To prepare LB medium for culturing Bacteria.
4. To study Bacterial culture methods (streak plate and pour plate methods).
5. To study table of Genetic Code and find amino acid sequence from mRNA codons.
6. To study mechanism of transcription in prokaryotes using model /charts / photographs / ppt /video.
7. To study mechanism of transcription in eukaryotes using model /charts /photographs / ppt /video.
8. To study mechanism of eukaryotic mRNA processing (5' capping, 3'tailing and splicing) using model/chart/photographs/ppt/video.
9. To study mechanism of translation in prokaryotes using model /charts /photographs /ppt /video.
10. To study mechanism of translation in eukaryotes using model /charts /photographs /ppt / video.

### **Suggested Readings:**

1. Cell and Molecular Biology (Eighth Edition): E. D. R. De Roberties and E. M. R. De Roberties, Jr.
2. Biochemistry and Molecular Biology of Plants (Second Edition): Bob B. Buchanan, Wilhelm Gruissem and Russell L. Jones.
3. Cell and Molecular Biology Concepts and Experiments (Second Edition): Gerald Karp
4. Biochemical Methods (Second Edition): Sadasivam and Manikkam.
5. Molecular Cell Biology: C. B. Powar.

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## Option-3

**B. Sc.**  
**Semester VI**  
**Discipline Specific Elective-I (DSE-I)**  
**Paper-I**  
**Economic Botany- I**  
**(48 Periods)**

**Unit-I** **(12 Period)**

1. Definition and scope of Economic Botany
2. Origin, distribution, botanical description, brief idea of cultivation and uses of following food yielding plants:
3. Cereals- (Rice, Wheat, Maize and Jowar)
4. Legumes and Pulses- Gram, Pigeon pea, Lentil, Pea, Green Gram, Black Gram

**Unit-II** **(12 Period)**

1. Origin, distribution, botanical description, brief idea of cultivation and uses of following vegetables, sugar and fruit yielding plants:
2. Vegetables- (Potato, Tomato, Brinjal, Onion, Chili)
3. Sugar- (Sugarcane)
4. Fruits- (Mango, Papaya)

**Unit-III** **(12 Period)**

1. Origin, distribution, botanical description, brief idea of cultivation and uses of following oil yielding plants and wild edible fruit plants:
2. Oil- (Ground nut, Mustard, Sesame, Soya bean, Coconut, Linseed)
3. Wild edible fruit plants- (Tembhurni, Charoli, Jambhul)

**Unit-IV** **(12 Period)**

1. Origin, distribution, botanical description, brief idea of cultivation and uses of following fiber and forage yielding plants:
2. Fiber- Cotton, Jute, Sun Hemp, Sisal Hemp, Flax
3. Forage- Lucerne, Fenugreek, Cowpea

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### **Laboratory Exercises:**

Note: - Make use of live or preserved specimens, plant parts, charts, pictures or Photographs of plants mentioned in the syllabus for study.

- 1) To study economically important food, pulses and vegetable yielding plants.
- 2) To study economically important Fruit yielding plants.
- 3) To study economically important oil yielding plants.
- 4) To study economically important fiber and forage yielding plants.

### **Suggested Readings:**

1. Economic Botany: B.P. Pandey
2. Economic Botany A comprehensive study: S.L. Kochhar
3. Economic Botany: Plants in Our World: Beryl Brintall Simpson and Molly Conner-Ogorzaly.
4. Economic Botany: Bendre Kumar
5. Botany for Degree Students: B. P. Pandey
6. Economic Botany: S. Sen

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**B. Sc.**  
**Semester VI**  
**Discipline Specific Elective-I (DSE-I)**  
**Paper-II**  
**Economic Botany- II**  
**(48 Periods)**

**Unit-I** **(12 Period)**

Origin, distribution, botanical description, brief idea of cultivation and uses of following plants used as spices, condiments and beverages:

- Spices - (Coriander, Ferula, Ginger, Garlic, Turmeric, Clove)
- Condiments- (Cardamom, Cinnamon, Black Paper, Nutmeg)
- Beverages - (Tea and Coffee)

**Unit-II** **(12 Period)**

Origin, distribution, botanical description, brief idea of cultivation and uses of following gum, rubber and dye yielding plants:

- Gum- (*Acacia arabica*, *Butea monosperma*)
- Rubber - (*Hevea*)
- Dye - (*Acacia catechu*, *Bixa orellana*)

**Unit-III** **(12 Period)**

Origin, distribution, botanical description, brief idea of cultivation and uses of following timber yielding plants and Bamboo:

- Timber- (Teak, Babool, Sissoo, Bija )
- Bamboo

**Unit-IV** **(12 Period)**

Origin, distribution, botanical description, brief idea of cultivation and uses of following plants used as medicine, essential oil and bio-fuels:

- Medicines- (Surpentine, Mango ginger, Aloe, Tulsi, Bael, Vasaka, Neem, Sadabahar)
- Essential Oil- *Citronella* oil (Lemon grass), *Vetiver* oil (Khus oil)
- Bio-fuels- *Ricinus communis*, *Pongamia pinnata*, *Jatropha curcus*.

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### **Laboratory Exercises:**

Note: Make use of live or preserve specimens, plant parts, charts, pictures or photographs for study.

1. To study economically important spices, condiments and beverages plants
2. To study economically important gum, rubber and dye yielding plants.
3. To study economically important timber yielding plants and Bamboo
4. To study economically important plants used for medicine, essential oil and bio-fuels
5. To perform biochemical tests for carbohydrates, proteins and fats.
6. To demonstrate the technique for extraction of essential oil from given plant material (Steam distillation)
7. To demonstrate the technique for extraction of bio-fuel from given plant material (Soxhlet Extraction Method)

### **Suggested Readings:**

1. Economic Botany: B.P. Pandey
2. Economic Botany A comprehensive study: S.L. Kochhar
3. Economic Botany: Plants in Our World: Beryl Brintall Simpson and Molly Conner-Ogorzaly.
4. Economic Botany: Bendre Kumar
5. Botany for Degree Students: B. P. Pandey
6. Economic Botany: S. Sen

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**GONDWANA UNIVERSITY, GADCHIROLI**  
**Practical Question Paper Pattern**  
**For**  
**B.Sc. BOTANY**  
**SEMESTER – V**  
**CBCS**

**PRACTICAL-V**  
Based on both Theory Papers  
Selected from the Options of DSE-I of Semester – V

**[Time 5 Hours]**

**[Max. Marks – 30]**

<b>Que. 1:</b> Based on <b>Paper I</b>	4Marks
<b>Que.2:</b> Based on <b>Paper I</b>	4Marks
<b>Que. 3:</b> Based on <b>Paper II</b>	4 Marks
<b>Que. 4:</b> Based on <b>Paper II</b>	4 Marks
<b>Que. 5:</b> Spotting	6 Marks
A. Based on <b>Paper I</b>	
B. Based on <b>Paper I</b>	
C. Based on <b>Paper I</b>	
D. Based on <b>Paper II</b>	
E. Based on <b>Paper II</b>	
F. Based on <b>Paper II</b>	
<b>Que. 6:</b> Viva-voce	3 Marks
<b>Que.7:</b> Practical Record and Excursion Report	5 Marks

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## SEMESTER – V:

### Skill Enhancement Courses (SEC-III)

**NOTE:**

1. Any one SEC is to be chosen from the pool of SEC of Core subjects selected by the student.
2. Complete programme of SEC is governed by the college.
3. EXAMINATION will be conducted by the college and the credits will be given to the student accordingly.
4. Choice of selecting SEC is within the pool of Core subjects selected by the student.  
(Example: CBZ, CBM, CZM, PCM, PEM, etc.)
5. Course comprises 30% theory and 70% practical.
6. Duration of the course is THREE MONTHS.  
(Theory- 72 hours + Practical- 266 hours = 288 hours)

SEC-III Options	Title of the Paper	Theory	Practical	Total Marks
Option-1	Gardener Training – (Basic)	30 Marks	70 Marks	100 Marks
Option-2	Mushroom Culture Technology	30 Marks	70 Marks	100 Marks
Option-3	Herbal Technology	30 Marks	70 Marks	100 Marks
Option-4	High Density Planting	30 Marks	70 Marks	100 Marks
Option-5	Floriculture	30 Marks	70 Marks	100 Marks

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**B. Sc.**  
**Semester V**  
**Skill Enhancement Courses (SEC-III)**  
**Option-1**  
**Gardener Training -(Basic)**  
**(Course period includes 30% Theory and 70% Practical hours)**

**Unit – I:** **(18 Hours)**

1. Introduction to Gardening
2. Garden Implements and Accessories
3. Area, Measurements, Volumes, Layout - Planning, Different Designs.
4. Containers - Earthen containers, pots, polybags, cement pots, ceramic pots.
5. Propagation - Seeds, cuttings, layering, budding and grafting

**Unit – II:** **(18 Hours)**

1. Types of Gardening - Formal, informal, landscape, institutions, public gardens, parks,
2. Hindu, Mughal, Japanese and English Gardens
3. Identification of ornamental plants, seasonal annuals, edges, hedges, shrubs, creepers, trees, vines (commercial nursery)

**Unit – III:** **(18 Hours)**

1. Features of Gardens - Gate, lawn, shrubbery, flower beds, borders, paths, hedges, edges, steps, statues, fountains, bird paths, streams, pools, water falls, rockery, arches, pergolas, hanging pots, bird paths, tea house.
2. Principles and Practices of landscape design for home gardens and public parks.
3. Ornamental Gardening - Scope; importance; nursery management; lawns, layout of lawn, grasses; lawn and its maintenance.

**Unit – IV:** **(18 Hours)**

1. Design and layout of gardens for home, school, college, public buildings, parks, villages and kitchen garden.
2. Green Houses-shade houses, uses, application in horticulture.
3. Pruning and training - objective and methods.
4. Principles of making bonsai.

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### **Laboratory Exercises:**

1. Study of Garden tools and equipments.
2. Study of containers - earthen containers, pots, poly bags, cement pots and ceramic pots.
3. Preparation of nursery beds and sowing of seeds.
4. Layout of land for lawn.
5. Preparation of land for lawn.
6. Designing of home gardens
7. Planting of woody plants, bulbs and bedding plants.
8. Planting of shrubbery, hedges and edges.
9. Identification and growing of indoor plants of their basic requirements.
10. Practice in making bonsai.
11. Raising of root stocks for grafting and budding.
12. Propagation of plants through cuttings.
13. Practicing of layering and stooling (Guava)
14. Practicing of grafting (Mango)
15. Practicing budding in rose / citrus.
16. Visit to commercial nursery in the locality.
17. Preparation of potting mixture, potting and repotting.
18. Study or ring basin method in mango / citrus orchard.
19. Study of check basin method in vegetables.
20. Study of sprinkler irrigation method.
21. Study of drip irrigation method.
22. Layout of model kitchen garden.
23. Planning and designing of different of gardens

### **Suggested Readings:**

1. Complete Gardening India - K.S.s Gopaldaswamiengar
2. Gardening in India - Bose T. K. and Mukherjee
3. Design Elements of Landscape Gardening - Nambisan K.M.P.
4. Text-Book of Horticulture - Rao K. M.
5. Fruits-topical and sub-tropical - Bose, T.K. and Mitra, S. K.
6. Vegetables - Chaudhary, B.
7. Floriculture in India - Randhawa, G.S. & Mukhopadhyay. A.

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**B. Sc.**  
**Semester V**  
**Skill Enhancement Courses (SEC-III)**  
**Option-2**  
**Mushroom Culture Technology**  
**(Course period includes 30% Theory and 70% Practical hours)**

**Unit – I:** **(18 Hours)**

**Introduction:**

History, nutritional and medicinal value of edible mushrooms; poisonous mushrooms.

Types of edible mushrooms cultivated in India (Species and varieties of *Volvariella*, *Pleurotus* and *Agaricus*).

**Unit - II:** **(18 Hours)**

**Cultivation Technology:**

Infrastructure, substrates (locally available), polythene bags, vessels, Inoculation hook, inoculation loop, low cost stove, sieves, culture rack, mushroom unit (thatched room) water sprayer, tray, packing material.

Pure culture: Culture medium, sterilization, preparation of spawn, multiplication.

Mushroom bed preparation: Sterilization of substrates, filling/bagging, inoculation of spawn, factors affecting.

Low cost composting technology for mushroom production.

**Unit - III:** **(18 Hours)**

**Storage and nutrition:**

Short term and long term storage (refrigeration, canning, drying, storage in salt solutions, making powder, pickel and papad).

**Unit - IV:** **(18 Hours)**

**Mushroom recipes:** Curry, salad, pickle, papad, soup etc.

**Research Centers** - National and Regional levels.

**Cost benefit ratio** - Marketing in India and abroad, Export value.

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**Laboratory Exercises:**

1. Identification of edible and poisonous mushrooms.
2. Microscopic observation of mushrooms.
3. Media preparation for spawn production.
4. Construction of mushroom cultivation sheds.
5. Sterilization practices for culture room.
6. Preparation of substrate beds using paddy straw/ agricultural wastes.
7. Spawn running and harvesting of mushroom.
8. Post harvest techniques: Grading, drying and packaging/canning.

**Suggested Readings:**

1. Marimuthu, T. Krishnamoorthy, A.S. Sivaprakasam, K. and Jayarajan. R (1991) Oyster Mushrooms, Department of Plant Pathology, Tamil Nadu Agricultural University, Coimbatore.
2. Swaminathan, M. (1990) Food and Nutrition. Bappco, The Bangalore Printing and Publishing Co. Ltd., No. 88, Mysore Road, Bangalore - 560018.
3. Tewari, Pankaj Kapoor, S.C., (1988). Mushroom cultivation, Mittal Publications, Delhi.
4. Nita Bahl (1984-1988) Hand book of Mushrooms, II Edition, Vol. I & Vol. II.

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**B. Sc.**  
**Semester V**  
**Skill Enhancement Courses (SEC-III)**  
**Option-3**

**Herbal Technology**

**(Course period include 30% Theory and 70% Practical hours)**

**Unit – I:** **(18 Hours)**

**Herbs as raw materials:**

Definition of herb, herbal medicine, herbal medicinal product, herbal drug preparation.  
Source of herbs, selection, identification and authentication of herbal materials.  
Processing of herbal raw material, basic principles involved in Ayurveda, Siddha, Unani and Homeopathy.  
Preparation and standardizaion of Ayurvedic formulations (Aristas and Asawas, Ghutika, Churna, Lehya and Bhasma).

**Unit – II:** **(18 Hours)**

**Herbal Nutraceuticals:**

General aspects, Market, growth, scope and types of products available in the market. Health benefits and role of herbal nutraceuticals in ailments like Diabetes, Cardiovascular diseases, Cancer, Irritable bowel syndrome and various Gastro intestinal diseases.

**Herbal cosmetics:**

Study and description of raw materials of herbal origin used such as fixed oils, waxes, gums, colours, perfumes, protective agents, bleaching agents, antioxidants in products such as skin care, hair care and oral hygiene products.

**Herbal excipients:**

Herbal Excipients – Significance of substances of natural origin as excipients – colorants, sweeteners, binders, diluents, viscosity builders, disintegrants, flavors & perfumes.

**Unit – III:** **(18 Hours)**

**Biodynamic Agriculture:**

Good agricultural practices in cultivation of medicinal plants including organic farming.  
Pest and Pest management in medicinal plants: Biopesticides/Bioinsecticides.

**General Introduction to Herbal Industry**

Herbal drugs industry: Present scope and future prospects. A brief account of plant based industries and institutions involved in work on medicinal and aromatic plants in India.

**Unit – IV:** **(18 Hours)**

**Evaluation of Drugs:**

WHO & ICH guidelines for the assessment of herbal drugs. Stability testing of herbal drugs.

**Schedule T – Good Manufacturing Practice of Indian systems of medicine:**

Components of GMP (Schedule – T) and its objectives. Infrastructural requirements, working space, storage area, machinery and equipments, standard operating procedures, health and hygiene, documentation.

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**Laboratory Exercises:**

1. To prepare crude herbal drugs illustrated in the theory syllabus at laboratory scale.
2. To prepare herbal formulations as illustrated in the theory syllabus at laboratory scale.
3. To perform preliminary phytochemical screening of crude drugs.
4. To evaluate excipients of natural origin.
5. To identify herbal drug sources based on morphological characters and microchemical tests.
6. To visit nearby herbal drug production unit.

**Suggested Readings:**

1. Kokate C.K., Gokhale AS, Gokhale SB, Cultivation of Medicinal Plants, Nirali Publication.
2. Henry TA. The Plant Alkaloids, Mc Graw Hill, New York.
3. Kokate, C.K. "Practical Pharmacognosy" Vallabh Prakashan Delhi.
4. Clarke ECG, Isolation & Identification of Drugs, The Pharmaceutical Press, London.
5. Chaudhary R. D., Herbal Drug Industry.
6. Mukherjee P. V., Quality Control Methods of Herbal Drugs.

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**B. Sc.**  
**Semester V**  
**Skill Enhancement Courses (SEC-III)**  
**Option-4**

**High Density Planting Techniques for Farms and Forest**  
**(Course period includes 30% Theory and 70% Practical hours)**

**Unit – I:** **(18 Hours)**

**Traditional farming and Forestation:**

Introduction, conventional methods of cropping in agriculture, horticulture and forestry, advantages and disadvantages.

**Unit - II:** **(18 Hours)**

**High Density Planting (HDP):**

Introduction, concept, principle, need, methods, advantages and disadvantages.

**Unit - III:** **(18 Hours)**

**HDP in Agriculture and Horticulture:**

Farm preparations, selection of varieties, sowing or planting distance, irrigation, fertigation, harvesting, pest and disease control.

**Unit - IV:** **(18 Hours)**

**HDP in Forestation :**

Reforestation, Afforestation;

Miyawaki High Density Rapid forestation method – Local forest survey, species selection, soil preparation, planting density, plantation techniques and management, advantages and disadvantages.

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### **Laboratory Exercises:**

1. To visit agriculture farm conducting conventional cropping systems.
2. To visit horticulture farm following conventional planting methods.
3. To visit reforested/afforested sites developed through conventional planting techniques.
4. To demonstrate high density plantation cropping for vegetable farm.
5. To demonstrate high density plantation cropping for horticulture farm.
6. To demonstrate Miyawaki technique for rapid reforestation/afforestation.

### **Suggested Readings:**

1. [http://www.worldagroforestry.org/treesandmarkets/hvc07\\_meet/other\\_materials/ICARDA/High%20density%20cropping.pdf](http://www.worldagroforestry.org/treesandmarkets/hvc07_meet/other_materials/ICARDA/High%20density%20cropping.pdf)
2. <https://www.biotecharticles.com/Agriculture-Article/High-Density-Planting-System-in-Fruit-Crops-3202.html>
3. <http://www.hillagric.ac.in/edu/coa/horticulture/lecture/Hort-351-Lectures/Hort-351-Lecture-6.pdf>
4. <http://agris.fao.org/agris-search/search.do?recordID=IN2011001034>
5. <http://www.pavalajaran.com/High%20Density.html>
6. [https://www.researchgate.net/publication/226157594\\_Effectiveness\\_of\\_the\\_Miyawaki\\_method\\_in\\_Mediterranean\\_forest\\_restoration\\_programs](https://www.researchgate.net/publication/226157594_Effectiveness_of_the_Miyawaki_method_in_Mediterranean_forest_restoration_programs)
7. <http://dindimavanam.com/miyawaki.htm>
8. <https://www.reforestaction.com/en/blog/akira-miyawaki-creator-primary-forests>

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**B. Sc.**  
**Semester V**  
**Skill Enhancement Courses (SEC-III)**  
**Option-5**

**Floriculture**

**(Course period include 30% Theory and 70% Practical hours)**

**Unit -I:** **(18 Hours)**

Introduction: History of gardening; Importance and scope of floriculture and landscape gardening. Nursery Management and Routine Garden Operations: Sexual and vegetative methods of propagation; Soil sterilization; Seed sowing; Pricking; Planting and transplanting; Shading; Stopping or pinching; Defoliation; Wintering; Mulching; Topiary; Role of plant growth regulators.

**Unit - II:** **(18 Hours)**

Ornamental Plants: Flowering annuals; Herbaceous perennials; Divine vines; Shade and ornamental trees; Ornamental bulbous and foliage plants; Cacti and succulents; Palms and Cycads; Ferns and *Selaginellas*; Cultivation of plants in pots; Indoor gardening; Bonsai.

**Unit - III:** **(18 Hours)**

Principles of Garden Designs: English, Italian, French, Persian, Mughal and Japanese gardens; Features of a garden (Garden wall, Fencing, Steps, Hedge, Edging, Lawn, Flower beds, Shrubbery, Borders, Water garden. Some Famous gardens of India. Landscaping Places of Public Importance: Landscaping highways and Educational institutions.

**Unit - IV:** **(18 Hours)**

Commercial Floriculture: Factors affecting flower production; Production and packaging of cut flowers; Flower arrangements; Methods to prolong vase life; Cultivation of Important cut flowers (Carnation, Aster, Chrysanthemum, Dahlia, Gerbera, Gladiolous, Marigold, Rose, Liliium, Orchids). Diseases and Pests of Ornamental Plants.

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### **Laboratory Exercises:**

1. Study floriculture, landscaping tools and implements
2. Identification of ornamental plants, seasonal annuals, edges, hedges, shrubs, creepers, trees, vines (commercial nursery)
3. Study of Garden Designs: English, Italian, French, Persian, Mughal and Japanese gardens.
4. Study of Features of a garden (Garden wall, Fencing, Steps, Hedge, Edging, Lawn, Flower beds, Shrubbery, Borders, Water garden).
5. Principles and Practices of landscape design for home gardens and public parks.
6. Principles of making bonsai.
7. Ornamental Gardening - Scope; importance; nursery management; lawns, layout of lawn, grasses; lawn and its maintenance.
8. Design and layout of gardens for home, school, college, public buildings, parks, villages and kitchen garden.
9. Preparation of nursery beds and sowing of seeds.
10. Identification and growing of indoor plants of their basic requirements.
11. Raising of root stocks for grafting and budding.
12. Propagation of plants through cuttings.
13. Practicing budding in rose / citrus.
14. Visit to commercial nursery in the locality.
15. Preparation of potting mixture, potting and repotting.
16. Study of sprinkler irrigation method.
17. Study of drip irrigation method.
18. Identification of commercial flowers.
19. Identification of diseases and insects and their control in important flowers.
20. Practicing of fertilizer application to cut flowers.
21. To study and demonstrate Floriculture technique.
22. To study the cultivation practices of commercially important flowers. (any four)
23. To study the construction of Green House Unit.

### **Suggested Readings**

1. Randhawa, G.S. and Mukhopadhyay, A. 1986. Floriculture in India. Allied Publishers.
2. S Prasad And U Kumar, A Handbook of Floriculture
3. Edward A. White, The Principles of Floriculture
4. Roy Larson, Introduction to Floriculture, 2nd Edition

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## Skill Enhancement Courses (SEC-III)

### Theory Examination Pattern

**Theory Question Paper Pattern  
For  
B.Sc. BOTANY CBCS  
SEMESTER – V  
Skill Enhancement Courses (SEC-III)**

Time: 02 Hours]

[Max. Marks- 30

- Q.1. Long question .....10 Marks
- Q.2. Short question
- a) .....5 Marks
- b) .....5 Marks
- Q.3. MCQ .....10 Marks  
(Ten MCQ each of ONE mark)

### Practical Examination Assessment Pattern (Max. Marks- 70)

Assessment of practical Examination is based on the following fulfillment by the student.

1.	Project Submission	20 Marks
2.	Project Presentation	20 Marks
3.	Assignments	10 Marks
4.	Field Visit	10 Marks
5.	Overall Performance /feedback	10 Marks
<b>Total Marks</b>		<b>70 Marks</b>

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## **SEC: Assessment of Project/Assignments:**

- Assessment of SEC will be made on Evaluation of the Written Format of Project Work consisting of 50 marks and Oral Interaction /Feedback with the students on Project / Theme consisting of 20 marks.
- A Project must consist of the following 6 Chapters:
  1. Introduction,
  2. Basic Concepts,
  3. Main Analysis on the selected Theme/ Theory,
  4. Supplementary or Complimentary Analysis to the Main Theme/Theory,
  5. Self-study Report & Conclusion ,
  6. List of References of Books & Other Materials.
- The Project & Assignment will follow the University approved Syllabi materials on Subject & Paper specific topics/themes/issues.
- The Project must consist of all the basic features including Cover Page, Preface, Certification by Guide and Contents etc. apart from Chapterisation.
- The word limits of a Project will be in between 2500 to 3500 and the word limits of an Assignment will be in between 400 to 500.

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**GONDWANA UNIVERSITY  
GADCHIROLI**



**FACULTY OF SCIENCE AND  
TECHNOLOGY**

**SYLLABUS**

**For**

T. Y. B. Sc.

**BOTANY**

**SEMESTER - VI**

**Under**

**Choice Based Credit System (CBCS)**

(With effect from: 2019-20)

**Scheme for Choice Based Credit System for B.Sc. Programme in**  
**BOTANY**

**SEMESTER – VI**

Semester	Core Course 6 Credits	Ability Enhancement Compulsory Course (2+2= 4 credits)	Skill Enhancement Courses SEC 2 Credits	Discipline Specific Elective DSE 6 Credits
<b>SEM-VI</b>			<p><b>SEC-IV</b> <u>Any one SEC</u> is to be chosen from the pool of SEC of Core subjects selected by the student.</p> <ol style="list-style-type: none"> <li><b>1. Gardener Training – (Advanced)</b></li> <li><b>2. Biofertilizers</b></li> <li><b>3. Ethnobotany</b></li> <li><b>4. Medicinal Botany</b></li> <li><b>5. Modern Farming Techniques</b></li> </ol>	<p><b>DSE II</b> <u>Two Papers of any one DSE</u> are to be chosen by the student from the Three Options given below.</p> <p><b>Option-1</b> <b>Paper - I:</b> Mycology and Plant Pathology - I <b>Paper - II:</b> Mycology and Plant Pathology - II</p> <p><b>Option-2</b> <b>Paper-I:</b> Plant Biotechnology – I <b>Paper-II:</b> Plant Biotechnology – II</p> <p><b>Option-3</b> <b>Paper-I:</b> Plant Diversity &amp; Conservation – I <b>Paper-II:</b> Plant Diversity &amp; Conservation - II</p> <p><b>PRACTICAL-VI</b> Based on Paper I and II of DSE selected by the student from the above mentioned Options-1, 2 and 3 of Semester-VI</p>

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**SEMESTER – VI:****Discipline Specific Elective-II (DSE-II)**

**NOTE: Student has to select any ONE from Three Options under DSE-II category.**

<b>Papers</b>	<b>Title of the Paper</b>	<b>Theory / Practical</b>	<b>Internal Assessment</b>	<b>Total Marks</b>
<b>Option-1</b>				
Paper – I	Mycology and Plant Pathology - I	50 Marks	10 Marks	60 Marks
Paper – II	Mycology and Plant Pathology - II	50 Marks	10 Marks	60 Marks
<b>Option-2</b>				
Paper – I	Plant Biotechnology – I	50 Marks	10 Marks	60 Marks
Paper – II	Plant Biotechnology – II	50 Marks	10 Marks	60 Marks
<b>Option-3</b>				
Paper – I	Plant Diversity and Conservation - I	50 Marks	10 Marks	60 Marks
Paper - II	Plant Diversity and Conservation - II	50 Marks	10 Marks	60 Marks
<b>Practical - VI</b>	Based on two papers of DSE – II selected by the student from the above mentioned Options- 1, 2 and 3 of Semester-VI	30 Marks	--	30 Marks
<b>Internal Assessment:</b> Based on Assignment, Seminar, Unit Test & Overall Attendance and P erformance of the student				

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## Option-1

**B. Sc.**  
**Semester V**  
**Discipline Specific Elective-II (DSE-II)**  
**Paper-I**  
**Mycology and Plant Pathology - I**

**Unit-I (Mycology):** **(12 Periods)**

1. Introduction, Definition, Objectives, Mycological institute in India (IARI and VINSTROM), progress and status of mycology in India.
2. General Characteristics and classification of fungi by G. C. Ainsworth, 1973 (outline only).
3. Pathogenic account on Mestigomycotina, Ascomycotina, Zygomycotina, Basidiomycotina and Deuteromycotina.

**Unit-II (Mycology):** **(12 Periods)**

1. Chemical composition of fungal cell wall and its functions.
2. Characteristics of fungi spores, types of spores based on spore production structure, function and motility.
3. General variations in fungi Heterokaryopsis, Parasexuality, Homothallism and Heterothallism.

**Unit-III (Plant Pathology):** **(12 Periods)**

1. Introduction, definition objectives importance of plant disease and plant pathology in 20<sup>th</sup> century.
2. Classification of plant disease on the basis of casual agents (non-parasitic & parasitic) and symptoms caused by fungi.
3. Method of studying plant disease – field observations, cutting of pathogenic organisms, culture media preparation, sterilization, isolation & purification & identification of culture, Koch's postulates.

**Unit-IV (Plant Pathology):** **(12 Periods)**

1. Impact of Environment on plant disease – effect of temperature, soil environment, relative humidity soil types & texture, wind, rainfall & light.
2. Enzymes & toxins in plant diseases – cellulolytic enzyme, pecticemzymes, pytooxins, vivotoxins & pathotoxins.
3. Defense mechanisms in plants – defense structures (Waxes & cuticles, structure of epidermal cell wall, structure of natural openings, cork layers, tyloses, gum deposition, synthesis of phenols) & hypersensitive reaction.
4. Principles of plant disease control – biological & chemical control, uses of disease resistance varieties & plant quarantine.

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**Laboratory Exercises: -**

Make use of permanent micro-preparation, temporary mounts, transparencies, photographs, charts etc.

1. Principles & working of tools, Equipments and other requirements in the Mycology & Plant Pathology laboratory.
2. Collection of Plant Disease from surrounding locality.
3. Identification of Diseased Material, their Symptoms and Characters.
4. General Mycological laboratory procedures.
5. Pathogenicity Test – Steps to perform Koch's Postulates.
6. To study the Preparation of Potato Dextrose Agar (PDA).
7. Pouring of Nutrient Media into Petri dishes and Slant preparation.
8. Sterilization Processes viz. Moist heat, Dry heat, Chemical and Radiation.

**NOTE:**

Frequent field visits in the surrounding areas to study the diseased plant vegetation (hosts) are necessary.

**Suggested Readings:**

1. Introductory Mycology – C. J. Alexopolus & C. W. Mims
2. A text book of fungi – B. R. Vashishta
3. A text book of Modern Plant Pathology – K. S. Bilgrami & H. C. Dube
4. Plant Pathology – R. S. Mehrotra
5. Plant Pathology – C. J. Walker
6. Fundamental of Plant Pathology – N. G. Ravichandra
7. Disease of Crop Plants in India – G. Rangaswami & A. Mahadevan

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**B. Sc.**  
**Semester V**  
**Discipline Specific Elective-II (DSE-II)**  
**Paper-II**  
**Mycology and Plant Pathology – II**

**Unit-I (Applied Mycology):** **(12 Periods)**

1. Role of fungi in industrial Mycology, scope & their utility.
2. Industrial application of fungal enzymes – protease, cellulose & invertase.
3. Production of alcoholic beverages, antibiotics, organic acids, alkaloids & ergot by using fungi.

**Unit –II (Applied Mycology)** **(12 Periods)**

1. Production of secondary metabolites by using fungi.
2. Role of fungi in agriculture and forestry & conservation of germplasm.
3. Cultivation of fungi for food – Mushrooms, mycoproteins & mycofoods & importance of medical mycology.

**Unit-III (Plant Disease):** **(12 Periods)**

Study of following disease with respect to symptoms, casual organisms, disease cycle & management.

**1. Cereal:**

- a) Grain Smut of Jowar
- b) Ergot of Bajra

**2. Pulses:**

- a) Wilt of pigeon Pea
- b) Yellow vein mosaic of Bean

**3. Vegetables:**

- a) Late blight of Potato
- b) Little leaf of Brinjal

**4. Oil seeds:**

- a) Tikka disease of Groundnut.
- b) Damping of Mustard.

**Unit-IV (Plant Disease):** **(12 Periods)**

Study of following disease with respect to symptoms, casual organisms, disease cycle & management.

**1. Fruits – Citrus Canker**

**2. Cash Crops**

- a. Wilt Disease of Cotton
- b. Red Rot of Sugarcane

**3. Ornamentals –**

- a. Powdery Mildew of Rose

**4. Weeds – Rust of *Euphorbia***

**5. Trees – *Cercospora* on *Albizzia* fruits.**

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### **Laboratory Exercises: -**

Make use of permanent micro-preparation, temporary mounts, transparencies, photographs, charts etc.

1. Collection of disease plant parts from surrounding locality.
2. Identification of diseased material, their symptoms and characters (Disease plants studied in syllabus).
3. Isolation of soil borne Fungi by dilution method.
4. Isolation of air borne Fungi on nutrient media.
5. Isolation of fungal pathogen from leaves.
6. Isolation of fungal pathogen from stems fruits and other aerial part.
7. Preparation of pure culture of Fungi and its identification.
8. Artificial inoculation of pathogen from diseased plant part to Petri dishes containing nutrient media.
9. Measurement of fungal growth by linear determination.
10. Study of locally available Mushrooms.
11. To study and demonstrate Mushroom culture technique.
12. To study the construction of Mushroom culture unit.
13. To test the sensitivity of microorganism against antibiotics.

#### **NOTE:**

Frequent field visits in the surrounding areas to study the disease plant vegetation (Hosts) are necessary.

#### **Suggested Readings:**

1. Introductory Mycology – C. J. Alexopolus & C. W. Mims
2. A text book of fungi – B. R. Vashishta
3. A text book of Modern Plant Pathology – K. S. Bilgrami & H. C. Dube
4. Experiments in Microbiology, Plant Pathology and Biotechnology – K. R. Aneja
5. Plant Pathology – R. S. Mehrotra
6. Plant Pathology – C. J. Walker
7. Fundamental of Plant Pathology – N. G. Ravichandra
8. Disease of Crop Plants in India – G. Rangaswami & A. Mahadevan

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## Option-2

**B. Sc.**  
**Semester VI**  
**Discipline Specific Elective-II (DSE-II)**  
**Paper-I**  
**Plant Biotechnology- I**  
**(48 Periods)**

**Unit – I** **(12 Periods)**

**Plant Tissue Culture:**

Definition, Historical perspective, Composition of media; nutrient and hormone requirements (role of vitamins and hormones), Major types of tissue culture media (MS, B5, N6).

**Unit – II** **(12 Periods)**

**Basis of PTC techniques:**

Totipotency, differentiation, dedifferentiation, redifferentiation, regeneration (direct and indirect), organogenesis, embryogenesis (somatic and zygotic).

**Unit – III** **(12 Periods)**

**Tissue Culture Techniques:**

Micropropagation, virus elimination, protoplast isolation, culture and fusion, Secondary metabolite production.

**Unit – IV** **(12 Periods)**

**Tissue Culture Techniques:**

Anther culture, pollen culture, ovary culture, production of haploids, triploids and hybrids, hardening of the tissue culture raised plants for field plantation, cryopreservation, germplasm conservation.

**Laboratory Exercises:**

1. To study laboratory setup for Plant Tissue Culture techniques.
2. To get acquainted with equipment's and instruments used in Plant Biotechnology laboratory.
3. To study various sterilization methods employed in Plant Biotechnology Laboratory.
4. To prepare Murashige and Skoog plant tissue culture medium.
5. To conduct surface sterilization and inoculation of different explants (leaf, nodal buds, seeds) from suitable plant for callus induction.
6. To demonstrate anther culture.

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**Suggested Readings:**

- 1. Biotechnology Expanding Horizons:** B. D. Singh.
- 2. Comprehensive Biotechnology:** K. G. Ramawat and Shaily Goyal.
- 3. Biotechnology:** U. Satyanarayana.
- 4. Plant Cell and Tissue Culture:** Indra K. Vasil.

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**B. Sc.**  
**Semester VI**  
**Discipline Specific Elective-II (DSE-II)**  
**Paper-II**  
**Plant Biotechnology- II**  
**(48 Periods)**

**Unit – I** **(12 Periods)**

**Transgenic Crop Production:**

Definition, methods of gene transfer – direct (electroporation, microinjection, microprojectile bombardment, silicon carbide mediated).

**Unit – II** **(12 Periods)**

**Transgenic Crop Production:**

Indirect method of gene transfer - *Agrobacterium*-mediated gene transfer,  
Selection of transgenics – selectable marker and reporter genes (luciferase, GUS, GFP).

**Unit – III** **(12 Periods)**

**Applications of Plant Biotechnology:**

Pest resistant plants (Bt-cotton); herbicide resistant plants (Roundup Ready soybean); transgenic crops with improved quality traits (Golden rice); improved horticultural varieties (Moondust carnations).

**Unit – IV** **(12 Periods)**

**Applications of Plant Biotechnology:**

Transgenic plants producing edible vaccines, biodegradable plastic, chloroplast transformation; biosafety concerns and ethics.

**Laboratory Exercises:**

1. To demonstrate micropropagation from callus/explants.
2. To isolate and culture protoplasts.
3. To prepare suspension culture for secondary metabolite production.
4. To study different methods of direct gene transfer using models / charts / photographs / ppt / video.
5. To study steps involved in the production of Bt cotton / Golden rice through models / charts / photographs / ppt / video.
6. To study steps involved in the production of transgenic plants producing edible vaccine / biodegradable plastic using models / charts / photographs / ppt / video.

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**Suggested Readings:**

1. **Biotechnology Expanding Horizons:** B. D. Singh.
2. **Comprehensive Biotechnology:** K. G. Ramawat and Shaily Goyal.
3. **Biotechnology:** U. Satyanarayana.
4. **Plant Cell and Tissue Culture:** Indra K. Vasil.

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## Option-3

**B. Sc.**  
**Semester VI**  
**Discipline Specific Elective-II (DSE-II)**  
**Paper-I**  
**Plant Diversity and Conservation- I**  
**(48 Periods)**

**UNIT – I:**

1. **Concept of Biodiversity:** Introduction, Definition and its importance
2. **Biodiversity** at global, national and local level.
3. **Biodiversity** at Genetic, Species, Ecosystem, and Agro level.

**UNIT – II:**

1. **Biodiversity** in Terrestrial Environment - Forests, Grasslands, Deserts.
2. **Biodiversity** in Aquatic Environment - Marine, Freshwater, Eustrine, Wetlands, Mangroves and Coral Reefs

**UNIT – III**

1. **Biodiversity distribution:** Hot spots of biodiversity of the world.
2. Biogeographically classification of India.
3. Phytogeographical classification of India
4. India as a Mega diversity Nation.

**UNIT – IV:**

1. Threats to biodiversity, loss of Biodiversity and its causes. Causes and factors of mass extinction.
2. Listing of Threatened biodiversity including vulnerable, rare, threatened, Endangered and extinct plant and animal species.
3. Red Data Book, Blue Data Book

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**B. Sc.**  
**Semester VI**  
**Discipline Specific Elective-II (DSE-II)**  
**Paper-II**  
**Plant Diversity and Conservation- II**  
**(48 Periods)**

**UNIT – I:**

1. Concept of Conservation with reference of Forest and wildlife.
2. **Conservation** values and ethics, Inventorisation of biological resources, Action plan of conservation.
3. **Conservation** and Prevention Acts in India. The Environment protection Act, 1986 The wildlife protection Act, 1971, 1972 The forest (conservation) Act, 1980 The Biodiversity Act.

**UNIT – II: (In situ)**

1. Conservation by a network of protected areas: Sanctuaries, National parks, Biosphere reserves.
2. Botanical gardens, Seed Banks; In-vitro repositories; Cryobanks.
3. Role of NGOs in conservation: Important NGOs in India WWF, ATREE, BNHS, WTI, Kalpavriksha, Important NGO movements- Chipko movement, Narmada Bachav Aandholan

**UNIT – III: Conservation through tissue Culture (Ex situ)**

1. **Plant tissue culture:** History, Introduction - History, Scope and Concepts of basic techniques in plant tissue culture. Laboratory requirements and organization. Sterilization - filter, heat, wet and chemical.
2. **Media preparation** - inorganic nutrients, organic supplements, carbon source, vitamins, gelling agents, phytohormones and growth regulators; composition of commonly used culture media (MS and Gamborg's)

**UNIT – IV: Conservation through tissue Culture**

1. Ornamental Plants for propagation in vitro, Selection of superior biotypes of orchids, roses, jasmine, Hibiscus and crotons; Clonal propagation of elite germplasms, clonal propagation strategies for commercial exploitations.
2. Recent applications of tissue culture techniques and biotechnology in the introduction of Economically important traits in horticultural, agricultural and medicinal plants.

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### **Laboratory Exercises: (Including Paper – I and Paper – II)**

- Field visits will be integral part of the Practical. Visits to nearby sea-shore, lake, pond, river, reserved forest, Buffer area of a reserve, inhabitations / settlements near wild life areas or any other relevant site must be arranged.
  - The report of these visits will be submitted as part of the Practical work.
1. On a phytogeographic map of India locate & demarcate major sanctuaries / national parks.
  2. Identify and describe false colour images of land use patterns from a satellite image; City, reservoir, forest, agricultural.
  3. Preparation of synthetic seeds for germplasm conservation using somatic embryos or other propagules.
  4. Design a self-guided trail for a nature reserve / biodiversity park and submit a report.
  5. Using a hand held GPS instrument locate coordinates of a demarcated field site (example college campus).
  6. To determine diversity indices (Shanon-Weiner, species richness, B-diversity) from given Data.
  7. Distribution pattern of different plant species determined by Quadrant/Transect/ Point centered Quarter methods.
  8. Qualitative parameters of distribution of plant species, Frequency, Density, Basal cover, dominance, Abundance and IVI.
  9. Preparation of media for Plant tissue culture.
  10. Surface sterilization.
  11. Cell suspension culture from different tissues.
  12. Isolation of explant, induction of callus, establishment and maintenance of callus.
  13. Visit to forest area to study important plant species and preparation of field diary.
  14. Visit to plant tissue culture laboratories in state & preparation of report.
  15. Undertake a survey of Tribal village near forest. Use a suitable questionnaire;
    - ✓ to record the extent of dependence of the community on the natural resource base,
    - ✓ to record their pattern of usage of the natural resource,
    - ✓ to document the anthropogenic influences on the ecosystem and
    - ✓ to suggest environment awareness programmes. Apply suitable Statistical tools for tabulating, representing and evaluating both quantitative and qualitative data obtained during the survey,
    - ✓ Interpret the results and make a report.

#### **NOTES:**

1. Frequent field visits in the surrounding areas to study the vegetation are necessary.
2. One long excursion is necessary along with excursion report duly signed by HOD.

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### **Suggested Readings: (Including Paper – I and Paper – II)**

1. Odum EP 1963 Ecology Holt Reinhart and Winston Inc.
2. Odum EP 1983 Basic Ecology, Saunders Publ Philadelphia.
3. Herman EB (2008) Media and Techniques for Growth, Regeneration and Storage 2005-2008. Agritech Publications, New York, USA.
4. Pierik RLM (1999) *In Vitro* Culture of Higher Plants. Kluwer Academic Publishers.
5. Prakash J & Pierik RLM (1991) Horticulture - New Technologies and Applications (Current Plant Science and Biotechnology in Agriculture). Kluwer Academic Publishers.
6. George EF, Hall MA and Geert-Jan De Klerk (2008). Plant Propagation by Tissue Culture (3rd Edition), Springer, Netherlands.
7. Journals: Plant Cell, Tissue and Organ Culture, Plant Cell Reports.
8. Wildlife Ecology, Conservation and Management. Anthony R.E. Sinclair, John M. Fryxell and Graeme Caughly Blackwell Publishing, U.S.A. 2006
9. Resources: Conservation and Use, CAB International, Oxon UK.
10. Bhojwani S.S. and Rajdan M.K. (1983) Plant Tissue Culture, Theory and Practice.

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**GONDWANA UNIVERSITY, GADCHIROLI**  
**Practical Question Paper Pattern**  
**For**  
**B.Sc. BOTANY**  
**SEMESTER – VI**  
**CBCS**

**PRACTICAL-VI**  
Based on both the Theory Papers  
Selected from the options of DSE-II of Semester – VI

<b>[Time 5 Hours]</b>	<b>[Max. Marks – 30]</b>
<b>Que. 1:</b> Based on <b>Paper I</b>	4Marks
<b>Que. 2:</b> Based on <b>Paper I</b>	4Marks
<b>Que. 3:</b> Based on <b>Paper II</b>	4 Marks
<b>Que. 4:</b> Based on <b>Paper II</b>	4 Marks
<b>Que. 5:</b> Spotting	6 Marks
<b>G.</b> Based on <b>Paper I</b>	
<b>H.</b> Based on <b>Paper I</b>	
<b>I.</b> Based on <b>Paper I</b>	
<b>J.</b> Based on <b>Paper II</b>	
<b>K.</b> Based on <b>Paper II</b>	
<b>L.</b> Based on <b>Paper II</b>	
<b>Que. 6:</b> Viva-voce	3 Marks
<b>Que.7:</b> Practical Record and Excursion Report	5 Marks

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## SEMESTER – V:

### Skill Enhancement Courses (SEC-IV)

**NOTE:**

7. Any one SEC is to be chosen from the pool of SEC of Core subjects by the student.
8. Complete programme of SEC is governed by the college.
9. EXAMINATION will be conducted by the college and the credits will be given to the student accordingly.
10. Choice of selecting SEC is within the pool of Core subjects selected by the student.  
(Example: CBZ, CBM, CZM, PCM, PEM, etc.)
11. Course comprises 30% theory and 70% practical.
12. Duration of the course is THREE MONTHS.  
(Theory 72 hours + Practicals 266 hours = 288 hours)

SEC-IV Options	Title of the Paper	Theory	Practical	Total Marks
Option-1	Gardener Training – (Advanced)	30 Marks	70 Marks	100 Marks
Option-2	Biofertilizers	30 Marks	70 Marks	100 Marks
Option-3	Ethnobotany	30 Marks	70 Marks	100 Marks
Option-4	Medicinal Botany	30 Marks	70 Marks	100 Marks
Option-5	Modern Farming Techniques	30 Marks	70 Marks	100 Marks

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**B. Sc.**  
**Semester VI**  
**Skill Enhancement Courses (SEC-IV)**  
**Option-1**  
**Gardener Training -((Advanced))**  
**(Course period include 30% Theory and 70% Practical hours)**

**Unit I:** **(18 Hours)**  
**Cultivation of Fruit Crops** like Mango, Sapota, Guava, Citrus and Pomegranate with special reference to selection of site, infrastructure required for plantations; nurseries for raising plant material, varieties, spacing, propagation, planting, training, pruning, weed control, plant protection etc.

**Unit II:** **(18 Hours)**  
**Cultivation of Vegetable Crops** like Tomato, Brinjal, bhendi, Chillies, Cabbage and Cauliflower, Palak and gourds.

**Unit III:** **(18 Hours)**  
**Cultivation of Flower Crops** like Rose, Jasmine, Chrysanthemum, Marigold and Tuberose.

**Unit IV:** **(18 Hours)**

1. **Cultivation of Bedding Plants**, Bulbs, pot plants and Aquatic plants.
2. **Study of Foliage Plants**

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### **Laboratory Exercises:**

1. Identification of fruit crops.
2. Digging and refilling of pits for planting of fruit crops.
3. Inter-culture operations in fruit trees.
4. Methods of training in grapes.
5. Methods of pruning in grapes / pomegranate.
6. Application of manures and fertilizers for fruit crops.
7. Identification and control of insect pests for fruit crops.
8. Identification and control of diseases in important fruit crops.
9. Participation in harvesting of fruit crops.
10. Visit to orchards.
11. Identification of vegetable seeds.
12. Preparation of land beds for important vegetable crops.
13. Preparation of nursery beds for important vegetables.
14. Participation in transplanting of vegetable seedlings in main field.
15. Use of manures and fertilizers as basal application of important vegetable crops.
16. Inter-culture operations like hoeing, earthing and staking in tomato.
17. Identification of important insect pests of vegetables and their control.
18. Identification of important diseases of vegetables and their control.
19. Participation in harvesting of vegetable crops.
20. Identification of commercial flowers.
21. Training and pruning in rose.
22. Practicing garden operations such as staking, pinching, de-suckering in cut flowers.
23. Practicing of fertilizer application to cut flowers.
24. Practicing pruning in jasmine.
25. Identification of diseases and insects and their control in important flower crops.
26. Identification of annuals, bi-annuals and perennials, bulbs and pot plants.
27. Identification of landscape trees, shrubs / climbers and ground covers.
28. Visit to commercial nursery.

### **Reference Books:**

1. Complete Gardening India - K.S.S Gopaldaswamiengar
2. Gardening in India - Bose T. K. and Mukherjee
3. Design Elements of Landscape Gardening - Nambisan K.M.P.
4. Text-Book of Horticulture - Rao K. M.
5. Fruits-tropical and sub-tropical - Bose, T.K. and Mitra, S. K.
6. Vegetables - Chaudhary, B.
7. Floriculture in India - Randhawa, G.S. & Mukhopadhyay. A.

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**B. Sc.**  
**Semester VI**  
**Skill Enhancement Courses (SEC-IV)**  
**Option-2**

**Biofertilizers**

**(Course period include 30% Theory and 70% Practical hours)**

**Unit I:** **(18 Hours)**

General account about the microbes used as biofertilizer – *Rhizobium* – isolation, identification, mass multiplication and carrier based inoculants; *Actinorrhizal* symbiosis.

**Unit II:** **(18 Hours)**

*Azospirillum*: isolation and mass multiplication – carrier based inoculant, associative effect of different microorganisms.

*Azotobacter*: classification, characteristics – crop response to *Azotobacter* inoculum, maintenance and mass multiplication.

Cyanobacteria (blue green algae), *Azolla* and *Anabaena azollae* association, nitrogen fixation, factors affecting growth, blue green algae and *Azolla* in rice cultivation.

**Unit III:** **(18 Hours)**

Mycorrhizal association, types of mycorrhizal association, taxonomy, occurrence and distribution, phosphorus nutrition, growth and yield – colonization of VAM – isolation and inoculum production of VAM, and its influence on growth and yield of crop plants

**Unit IV:** **(18 Hours)**

Organic farming – Green manuring and organic fertilizers, recycling of biodegradable municipal, agricultural and Industrial wastes – Bio-compost making methods,

Types and method of vermin-composting – Field Applications.

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### **Laboratory Exercises:**

1. To get acquainted with microscope and other laboratory equipment's.
2. To study various methods of sterilization.
3. To prepare nutrient medium to culture micro-organisms
4. To isolate Rhizobium from legume root nodule.
5. To isolate Azatobacter from soil.
6. To isolate Azospirillum from roots.
7. To isolate and culture Blue Green Algae.
8. To perform Gram staining for identification of Bacteria.
9. To isolate Mycorrhiza.
10. To prepare commercial fertilizers from *Rhizoiium*, *Azotobacter*, and *Azospirillum*.
11. To prepare commercial fertilizers from *BGA* and *Azolla*.
12. To estimate efficiency of *Rhizobium* through pot culture experiment.
13. To study different methods of application of Biofertilizers

### **Suggested Readings:**

1. Dubey, R.C., 2005 A Text book of Biotec hnology S.Chand & Co, New Delhi.
2. Kumaresan, V. 2005, Biotechnology, Saras Publications, New Delhi.
3. John Jothi Prakash, E. 2004. Outlines of Plant Biotechnology. Emkay Publication, New Delhi.
4. Sathe, T.V. 2004 Vermiculture and Organic Farming. Daya publishers.
5. Subha Rao, N.S. 2000, Soil Microbiology, Oxford & IBH Publishers, New Delhi.
6. Vayas,S.C, Vayas, S. and Modi, H.A. 1998 Bio -fertilizers and organic Farming Akta Prakashan, Nadiad

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**B. Sc.**  
**Semester VI**  
**Skill Enhancement Courses (SEC-IV)**  
**Option-3**

**Ethnobotany**  
**(Course period include 30% Theory and 70% Practical hours)**

**Unit 1: Ethnobotany (18 Hours)**

- a) Introduction, concept, scope and objectives; Ethnobotany as an interdisciplinary science.
- b) Tribal's of India, and their life styles
- c) Major and minor ethnic groups
- d) Role of ethnic groups in conservation of plant genetic resources.

**Unit 2: Methodology of Ethnobotanical studies (18 Hours)**

- a) Field work b) Herbarium c) Ancient Literature d) Archaeological findings e) temples and sacred places
- f) Food plants: Vegetables, Fruits and Seeds
- g) Intoxicants and Beverages
- h) Resins and Oils and Miscellaneous uses.

**Unit 3: Role of Ethnobotany in modern Medicine (18 Hours)**

Medico-ethnobotanical sources in India; Significance of the following plants in ethnobotanical practices (along with their habitat and morphology)

*Commiphora mukul (Ghuggul), Vitex negundo, Rauwolfia serpentina, Withania somnifera, Bacopa monnieri, Curcuma longa (Haldi), Azadirachta indica, Allium sativum, Gloriosa superba, Cassia auriculata, Pongamia pinnata*

**Unit 4: Ethnobotany and legal aspects (18 Hours)**

Ethnobotany as a tool to protect interests of ethnic groups. Sharing of wealth concept with few examples from India. Biopiracy, Intellectual Property Rights and Traditional Knowledge.

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## Laboratory Exercises:

### A. To study the locally available plants used by the natives for the ailments of various diseases. (any five)

1. Plant used to cure the arthritis
2. Plant used to cure the Piles
3. Plant used to cure the Jaundice
4. Plant used against snake bites
5. Plant used to cure the Diabetes
6. Plant used against Fever
7. Plant used against Scorpion/ Insect bite

### B. To study ancient Seed germination / vegetative Propagation techniques.

### C. Ancient method of breaking of seed dormancy.

### D. Visit to Bamboo cultivation center and Bamboo Craft Centre.

### E. To study the methods of cultivation of medicinally important plants.

1. *Aloe vera* (Korphan)
2. *Chlorophytum borivillianum* (Safed Musli)
3. *Withania somnifera* (Ashwagandha)
4. *Asparagus* (Satavari)
5. *Adhatoda vasica* (Adulsa)

## Suggested Readings:

1. S.K. Jain, Manual of Ethnobotany, Scientific Publishers, Jodhpur, 1995.
2. S.K. Jain (ed.) Glimpses of Indian. Ethnobotany, Oxford and I B H, New Delhi – 1981  
Lone et al, Palaeoethnobotany.
3. S.K. Jain (ed.) 1989. Methods and approaches in Ethnobotany. Society of Ethno botanists, Lucknow, India.
4. S.K. Jain, 1990. Contributions of Indian Ethnobotany, Scientific publishers, Jodhpur.
5. Colton C.M. 1997. Ethnobotany – Principles and applications, John Wiley and sons – Chichester.
6. Rama Ro, N and A.N. Henry (1996). The Ethnobotany of Eastern Ghats in Andhra Pradesh, India. Botanical Survey of India Howrah.
7. Rajiv K. Sinha – Ethnobotany the Renaissance of Traditional Herbal Medicine – INA – SHREE Publishers, Jaipur-1996.

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**B. Sc.**  
**Semester VI**  
**Skill Enhancement Courses (SEC-IV)**  
**Option-4**

**Medicinal Botany**

**(Course period include 30% Theory and 70% Practical hours)**

**Unit I:** **(18 Hours)**

History, Scope and Importance of Medicinal Plants. Indigenous Medicinal Sciences; Definition and Scope-Ayurveda: History, origin, panchamahabhutas, saptadhatu and tridosha concepts, Rasayana, plants used in ayurvedic treatments, Siddha: Origin of Siddha medicinal systems, Basis of Siddha system, plants used in Siddha medicine. Unani: History, concept: Umoor-e- tabiya, tumors treatments/ therapy, polyherbal formulations.

**Unit II:** **(18 Hours)**

Conservation of endangered and endemic medicinal plants. Definition: endemic and endangered medicinal plants, Red list criteria; In situ conservation: Biosphere reserves, sacred groves, National Parks; Ex-situ conservation: Botanic Gardens, Ethnomedicinal plant Gardens.

**Unit III:** **(18 Hours)**

Propagation of Medicinal Plants: Objectives of the nursery, its classification, important components of a nursery, sowing, pricking, use of green house for nursery production, propagation through cuttings, layering, grafting and budding.

**Unit IV:** **(18 Hours)**

Ethnobotany and Folk medicines. Definition; Ethnobotany in India: Methods to study ethnobotany; Applications of Ethnobotany: National interacts, Palaeo-ethnobotany. Folk medicines of ethnobotany, ethnomedicine, ethnoecology, ethnic communities of India. Application of natural products to certain diseases- Jaundice, cardiac, infertility, diabetics, Blood pressure and skin diseases

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### **Laboratory Exercises:**

1. Study of Locally available medicinal plants.
2. Study of plants used in Siddha medicine.
3. Study of Unani system of medicine.
4. Study of plants used to treat Jaundice, cardiac, infertility, diabetics, Blood pressure and skin diseases.
5. Ex-situ conservation of important medicinal plants.
6. Propagation of Medicinal Plants through cuttings, layering, grafting and budding.
7. To study the construction of Green House Unit.
8. Preparation of nursery beds and sowing of seeds.
9. To prepare crude herbal drugs from locally available plants at laboratory scale.

### **Suggested Readings:**

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.

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**B. Sc.**  
**Semester VI**  
**Skill Enhancement Courses (SEC-IV)**  
**Option-5**

**Modern Farming Techniques**

**(Course period include 30% Theory and 70% Practical hours)**

**UNIT I:** **(18 Hours)**

**Traditional Agriculture** – Introduction, methods, advantages and disadvantages,

**Modern Agriculture** – Introduction, methods (Aeroponics, Aquaponics, Hydroponics, Tissue culture, Vertical Farming, Rooftop Farming), need and scope, advantages and disadvantages.

**UNIT II:** **(18 Hours)**

**Aeroponics** – Technology and tools, benefits and scope in India,

**Aquaponics** – Technology and tools, RAS Fish farming (Recirculating Aquaculture System, benefits and scope in India,

**Hydroponics** - Technology and tools, benefits and scope in India.

**UNIT III:** **(18 Hours)**

**Tissue culture in Modern Farming** – Technology and tools, benefits and scope in India,

**Vertical Farming** - Technology and tools, benefits and scope in India,

**Rooftop Farming** - Technology and tools, benefits and scope in India,

**Monoculture of Modern Farming** – Organic Farming and Industrial Farming, Hydrogel Farming,

**UNIT IV:** **(18 Hours)**

**Hybrid Seed Technology** - Technology and tools, benefits and scope in India,

Use of Drones in Modern Agriculture,

Use of Agriculture / Farming Software.

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### **Laboratory Exercises:**

1. To study existing cropping system in nearby villages.
2. To demonstrate aeroponics system for crop production.
3. To illustrate maintenance of aeroponics farming.
4. To demonstrate aquaponics system for crop production.
5. To illustrate maintenance of aquaponics farming.
6. To demonstrate application of plant tissue culture in agriculture.
7. To demonstrate vertical farming technique.
8. To demonstrate rooftop and kitchen farming techniques.
9. To demonstrate hydrogen farming.
10. To illustrate use of Agriculture software for crop maintenance.

### **Suggested Readings:**

1. R. W. Zobel, Peter Del Tredici, and J. G. Torrey. Method for Growing Plants Aeroponically  
Plant Physiol. (1976) 57, 344-346.
2. [J. Heinrich Lieth](#) and [Michael Raviv](#). Soilless Culture: Theory and Practice; Elsevier Science  
**ISBN: 9780444529756**
3. L. A. Withers and P. G. Alderson, Plant Tissue Culture and Its Agricultural Applications 1st  
Edition Butterworth-Heinemann, eBook ISBN: 9781483192055

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## **Skill Enhancement Courses (SEC-IV)**

### **Theory Examination Pattern**

**Theory Question Paper Pattern  
For  
B.Sc. BOTANY CBCS  
SEMESTER – VI  
Skill Enhancement Courses (SEC-IV)**

**Time: 02 Hours]**

**[Max. Marks- 30**

- Q.1. Long question .....10 Marks**
- Q.2. Short question**
- a) .....5 Marks
- b) .....5 Marks
- Q.3. MCQ .....10 Marks**  
(Ten MCQ each of ONE mark)

### **Practical Examination Assessment Pattern**

Assessment of practical Examination is based on the following fulfillment by the student.

6.	Project Submission	20 Marks
7.	Project Presentation	20 Marks
8.	Assignments	10 Marks
9.	Field Visit	10 Marks
10.	Overall Performance	10 Marks
<b>Total Marks</b>		<b>70 Marks</b>

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### **SEC: Assessment of Project/Assignments:**

- Assessment of SEC will be made on Evaluation of the Written Format of Project Work consisting of 50 marks and Oral Interaction /Feedback with the students on Project / Theme consisting of 20 marks.
- A Project must consist of the following 6 Chapters:
  1. Introduction,
  2. Basic Concepts,
  3. Main Analysis on the selected Theme/ Theory,
  4. Supplementary or Complimentary Analysis to the Main Theme/Theory,
  5. Self-study Report & Conclusion,
  6. List of References of Books & Other Materials.
- The Project & Assignment will follow the University approved Syllabi materials on Subject & Paper specific topics/themes/issues.
- The Project must consist of all the basic features including Cover Page, Preface, Certification by Guide and Contents etc. apart from Chapterisation.
- The word limits of a Project will be in between 2500 to 3500 and the word limits of an Assignment will be in between 400 to 500.