

**VIKRAMA SIMHAPURI UNIVERSITY: NELLORE**

**BOS APPROVED SYLLABUS OF B.Sc BOTANY MINORS SYLLABUS  
(II – VI SEMESTERS) FOR THE ACADEMIC YEAR 2023-2024**  
(With Learning Outcomes, Unit-wise Syllabus, References, Co-curricular Activities & Model Question Papers and Scheme of Examinations)



**PROGRAMME: B.Sc., IV YEAR HONOURS - BOTANY**

**(To be Implemented from 2023-2024)**

To

Dt: 30/12/2023

The Registrar  
Vikrama Simhapuri University  
SPSR Nellore

From

V. Vasundhara Devi  
Chairman & Ex-Officio Member  
Department of Botany  
J. B. College  
Kavali-SPSR Nellore

Respected Sir,

**Sub:** Requesting to conduct BOS meeting for (UG) BOTANY – 2023-2024 online meeting regarding dated on 27.12.2023

**Ref:** Proceedings of the Vice-Chancellor Rc.No.VSU/CDC/Const.of BOS/2023-2024,  
Dated: 09.10.2023

With respect to your letter through email dated on 27/12/2023 ,I am here with forwarding the minutes and agenda of Board of Studies in (UG) Minors of Botany online meeting held on 30.12.2023 through google meet and members of the board have attended and discussed about the given syllabus and approved the syllabus which will be implemented from the academic year 2023 – 2024.

Thanking you sir,

Yoursfaithfully

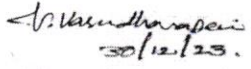
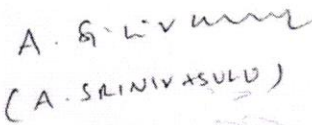
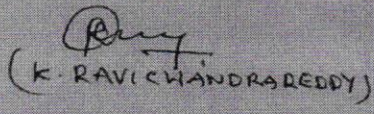
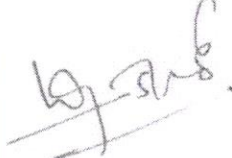

*V. Vasundhara Devi*  
30/12/23.

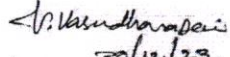
V. Vasundhara Devi  
Chairman & Ex-Officio Member  
Department of Botany  
J. B. College  
Kavali-SPSR Nellore

**Vikrama Simhapuri University**  
**Board of Studies- Botany(UG)**

Vikrama Simhapuri University, Board of Studies-Botany(UG) meeting was conducted online for Minors of Botany from 30/12/2023 through google meet . The following are the members attended who discussed the issues thoroughly and approved I,II and III -year (II,III,IV and V semesters) syllabi, both Theory and Practical.

**Members attended:**

<b>1) Smt. V. Vasundhara Devi</b> Chairman & Ex-Officio Member Lecturer in Botany, J.B. College Kavali-SPSR Nellore-Ph:9494642742	 30/12/23.
<b>2) Sri. A. Srinivasulu,</b> Internal Lecturer in Botany Visvodaya Govt. Degree College, Venkatagiri-SPSR Nellore-Ph:9440521446	 (A. SRINIVASULU)
<b>3) Sri. K. Ravichandra Reddy,</b> Internal Lecturer in Botany PRR & VSGovernment College Vidavalur-SPSR Nellore-Ph::9490219345	 (K. RAVICHANDRA REDDY)
<b>4) Sri D. Anil Kumar,</b> Internal Lecturer in Botany M.R.R. Govt Degree College, Udayagiri-SPSR Nellore-Ph:9573736401	
<b>5) Dr. T. Chakradhar</b> , Industry expert Senior Agronomist Coromandel International Ltd, Hyderabad, Ph:9573443691	

  
30/12/23.

**VIKRAMA SIMHAPURI UNIVERSITY: NELLORE**  
**BOARD OF STUDIES (UG) OF BOTANY, MINORS**  
**(II – V SEMESTERS) FOR THE ACADEMIC YEAR**

2023-2024

MINUTES OF THE BOARD OF STUDIES OF UG ONLINE MEETING HELD  
ON 30.12.2023 THROUGH GOOGLE MEET

**AGENDA ITEM-1: APPROVAL OF UG MINORS OF**  
**BOTANY (II – V SEMESTERS) FOR THE**  
**ACADEMIC YEAR 2023-2024**

- Approved the Syllabus with some modifications without disturbing the framework provided by you.

**AGENDA ITEM-2: MODIFICATIONS OF SYLLABUS**

- It is resolved and approved the modifications as given following format.

<b>VSU-BOTANY-BOS(2022-2023)(I,II,III,IV&amp;V Semesters)</b>				
S.No	Semester	Paper		Suggestions and Recommendations
1	Sem-II	<u><b>Course -I:</b></u>  <b>Non-vascular Plants –(T)</b> <b>Non-vascular Plants –(P)</b>	Theory	<b>UNIT – 1</b> 3. life cycles in algae deleted  <b>UNIT – 2</b> 2. A brief account of Bacillariophyceae deleted
			Practical	Model Question paper was prepared
2	Sem-III	<u><b>Course -II:</b></u>  <b>Vascular Plants</b> <b>(Pteridophytes, Gymnosperms and</b> <b>Taxonomy of Angiosperms)</b>	Theory	<b>Unit – 3</b> 5. Phylogenetic systematic deleted
			Practical	Model Question paper was prepared

*V. Sundharapriya*  
30/12/23.

3	Sem-IV	<b>Course -III:</b>  Anatomy and Embryology of Angiosperms	Theory	Unit – 2 5) Applications of anatomy in plant systematics, forensics and pharmacognosy deleted
			Practical	Model Question paper was prepared
4	Sem-IV	<b>Course -IV:</b>  Plant Ecology, Biodiversity and Phytogeography	Theory	Unit – 5 3) Phytogeographic regions of World deleted
			Practical	Model Question paper was prepared
5	Sem-V	<b>Course-V:</b>  Cell Biology and Genetics	Theory	Unit – 3 1) Multiple allelism deleted 4) Concepts of Maternal Inheritance deleted
			Practical	Model Question paper was prepared
6	Sem-V	<b>Course-VI:</b>  Plant Physiology and Metabolism		Unit – 2 4) Pentose Phosphate Pathway(HMP SHUNT) deleted
			Practical	Model Question paper was prepared

#### AGENDA ITEM-3 MODEL QUESTION PAPER

- It is resolved and approved to retain the model question paper as it is

#### AGENDA ITEM-4 : SCHEME OF EXAMINATION

- It is resolved and approved the scheme of examination as it is.

#### AGENDA ITEM-5 : LIST OF PANEL OF EXAMINERS

- Smt. V. Vasundhara Devi**  
Lecturer in Botany, J.B Degree College  
Kavali-SPSR Nellore-Ph:9494642742
- Sri. A. Srinivasulu** Lecturer in Botany  
Visvodaya Govt. Degree College, Venkatagiri  
SPSR Nellore - Ph:9440521446
- Sri. K. Ravichandra Reddy**, Lecturer in Botany  
PRR & VS Government College Vidavalur –  
SPSR Nellore - Ph: :9490219345
- Sri D. Anil Kumar** , Lecturer in Botany  
M.R.R. Govt Degree College, Udayagiri –  
SPSR Nellore - Ph:9573736401.

*V. Vasundhara Devi*  
30/12/23.

B.Sc HONOURS DEGREE EXAMINATIONS UG  
COMMON MODEL QUESTION PAPER

Time:3 Hours

Max.Marks:75

SECTION-A

Answer any FIVE of the following (Marks:  
5 x 5 marks = 25 marks)

- 1.
- 2.
- 3.
- 4.
- 5.
- 6.
- 7.
- 8

SECTION-B

Answer any FIVE of the following  
(Marks: 5 x 10 marks = 50marks)

9. (a)  
or  
(b)

UNIT-I

10. (a)  
Or  
(b)

UNIT-II

11. (a)  
Or  
(b)

UNIT-III

12. (a)  
Or  
(b)

UNIT-IV

13. (a)  
Or  
(b)

UNIT-V

*V. Vasudharamani*  
30/12/23.

# VIKRAMA SIMHAPURI UNIVERSITY: NELLORE

## BOS Approved Syllabus

### BOTANY : MINOR

w.e.f. 2023-24 AY onwards

#### COURSE STRUCTURE

Year	Semester	Course	Title	No. Hrs./ Week	No. of Credits
	II	1	Non-vascular Plants –(T)	3	3
			Non-vascular Plants –(P)	2	1
II	III	2	Vascular Plants –(T)	3	3
			Vascular Plants –(P)	2	1
	IV	3	Anatomy and Embryology of Angiosperms–(T)	3	3
			Anatomy and Embryology of Angiosperms–(P)	2	1
		4	Plant Ecology, Biodiversity and Phytogeography–(T)	3	3
			Plant Ecology, Biodiversity and Phytogeography–(P)	2	1
III	V	5	Cell Biology and Genetics–(T)	3	3
			Cell Biology and Genetics–(P)	2	1
		6	Plant Physiology and Metabolism–(T)	3	3
			Plant Physiology and Metabolism–(P)	2	1

*V. Vasudhampati*  
30/12/23.

### Semester-III

#### Course 2 : Vascular Plants (Pteridophytes, Gymnosperms and Taxonomy of Angiosperms)

Credits -3

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**I. Learning Objectives:** By the end of this course the learner has:

1. To recognize the morphology, anatomy and reproduction in two groups of archegoniates.
2. To acquire knowledge of the taxonomic aids and classification systems.
3. To read the vegetative and floral characteristics of some forms of angiospermic families along with their economic value.
4. To study the significance of other branches of botany in relation to plant taxonomy.

**II. Learning Outcomes: On completion of this course students will be able to:**

1. Infer the evolution of vasculature, heterospory and seed habit in Pteridophytes.
2. Illustrate the general characteristics of Gymnosperms along with their uses
3. Discuss about some Taxonomic aids and their applications in plant systematics.
4. Compare and contrast the vegetative and floral characteristics of some angiospermic families
5. Evaluate the economic value of plant species from the families under the study.
6. Defend the utility of evidences from different branches of botany in solving the taxonomic lineages of some species.

**III. Syllabus of Theory:**

**Unit-1: Pteridophytes**

**10Hrs.**

1. General characteristics of Pteridophyta; Smith (1955) classification.
2. Occurrence, morphology, anatomy, reproduction (developmental details are not needed) and life history of: (a) Lycopside: *Lycopodium* and (b) Filicopsida: *Marsilea*
3. Stelar evolution in Pteridophytes; Heterospory and seed habit.
4. Ecological and economic importance of Pteridophytes.

**Unit-2: Gymnosperms**

**10Hrs.**

1. General characteristics of Gymnosperms; Sporne (1965) classification.
2. Occurrence, morphology, anatomy, reproduction (developmental details are not needed) and life history of: (a) Cycadopsida: *Cycas* and (b) Gnetopsida: *Gnetum*
3. Ecological and economic importance of Gymnosperms.

*V. Vasudhan Devi*  
30/12/23.

**Unit-3: Principles of Plant Taxonomy****10 Hrs.**

1. Aim and scope of taxonomy, species concept, taxonomic hierarchy-major and minor categories.
2. Plant nomenclature: Binomial system, ICBN- rules for nomenclature.
3. Herbarium and its techniques, BSI herbarium and Kew herbarium; concept of digital herbaria.
4. Bentham and Hooker system of classification.
5. APG-IV classification.

**Unit-4: Descriptive Plant Taxonomy****8 Hrs.**

Systematic description and economic importance of the following families:

1. Polypetalae: (a) Annonaceae (b) Curcubitaceae
2. Gamopetalae: (a) Asteraceae (b) Asclepiadaceae
3. Monochlamydae: (a) Amaranthaceae (b) Euphorbiaceae
4. Monocotyledonae: (a) Arecaceae (b) Poaceae

**Unit-5: Evidences for Plant systematics****7Hrs.**

1. Anatomy and embryology in relation to plant systematics.
2. Cytology and cytogenetics in relation to plant systematics.
3. Phytochemistry in relation to plant systematics.
4. Numerical taxonomy
5. Origin and evolution of angiosperms.

**IV. Text Books:**

1. Acharya, B.C., (2019) Archchegoniaties, Kalyani Publishers, New Delhi
2. Bhattacharya, K., G. Hait&Ghosh, A. K., (2011) A Text Book of Botany, VolumeII, New Central Book Agency Pvt. Ltd., Kolkata
3. Hait,G., K.Bhattacharya&A.K.Ghosh (2011) A Text Book of Botany, Volume-I, New Central Book Agency Pvt. Ltd., Kolkata
4. Pandey, B.P. (2013) College Botany, Volumes-I&II, S. Chand Publishing, New Delhi

*V. Sundharajani*  
30/12/23.

## V. Reference Books:

1. Smith, G.M. (1971) Cryptogamic Botany Vol. II., Tata McGraw Hill, New Delhi
2. Sharma, O.P. (2012) Pteridophyta. Tata McGraw-Hill, New Delhi
3. Sporne, K.R. (1971) The Morphology of Gymnosperms. Hutchinsons Co. Ltd., London
4. Coulter, J.M. & C.J. Chamberlain (1910) Morphology of Gymnosperms, The University of Chicago Press, Chicago, Illinois
5. Bhatnagar, S.P. & Alok Moitra (1996) Gymnosperms. New Age International, New Delhi
6. Sambamurthy, A.V.S.S. (2005) Taxonomy of Angiosperms I. K. International Pvt. Ltd., New Delhi
7. Singh, G. (2012). Plant Systematics: Theory and Practice. Oxford & IBH Pvt. Ltd., New Delhi.
8. Simpson, M.G. (2006). Plant Systematics. Elsevier Academic Press, San Diego, CA, U.S.A.

## VI. Suggested activities and evaluation methods:

**Unit-1: Activity:** Making temporary slides/models/drawings of Pteridophytes in the syllabus.

**Evaluation method:** Assessment of the temporary slides/model/drawing.

**Unit-2: Activity:** Study of wood elements in locally available Gymnosperms and making temporary slides.

**Evaluation method:** Validation of prepared slides submitted by the learner.

**Unit-3: Activity:** Botanical field trip and collecting plant specimens for herbarium.

**Evaluation method:** Attendance in field trip and submission of field note book and herbarium sheets with filled in labels.

**Unit-4: Activity:** Making good models or drawings or collection of photographs of some important plant species from the families included in the syllabus.

**Evaluation method:** Authorize the quality of the work and conferring reward.

**Unit-5: Activity:** Collection of scientific literature on solving taxonomic problems by taking evidences from other branches of Botany.

**Evaluation method:** Validation of the collection submitted along with summary.

*V. Sundharani*  
30/12/23.

### III Semester

#### Course 2: Vascular Plants (Pteridophytes, Gymnosperms and Angiosperm Taxonomy)

Credits -1

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**I. Course Outcomes:** On successful completion of this practical course, student shall be able to:

1. Distinguish the Pteridophytes and Gymnosperms based on their morphological, anatomical and reproductive structures.
2. Make systematic classification of plant species using vegetative and floral characters.
3. Identify angiosperm plant species and make herbarium specimens.

**II Laboratory/field exercises:**

I. Study/ microscopic observation of vegetative, sectional/anatomical and reproductive structures of the following using temporary or permanent slides/specimens/ mounts:

1. Pteridophyta: *Lycopodium* and *Marselia*

2. Gymnosperms: *Cycas* and *Gnetum*

II. Technical description of locally available plant species from the following angiosperm families:

- |                  |                  |               |                   |
|------------------|------------------|---------------|-------------------|
| 1. Annonaceae    | 2. Cucurbitaceae | 3. Asteraceae | 4. Asclepiadaceae |
| 5. Amaranthaceae | 6. Euphorbiaceae | 7. Arecaceae  | 8. Poaceae        |

III. Demonstration of herbarium techniques.

IV. Field trip to a local floristic area/forest (Submission of 30 number of Herbarium sheets of wild plants with the standard system are mandatory).

*V. Vasudha Raju*  
30/12/23.

**Model Question Paper for Practical Examination**

**Semester – III/ Botany Course – II**

**Vascular Plants (Pteridophytes, Gymnosperms and Angiosperm Taxonomy)**

Max. Time: 3 Hrs.

Max Marks: 50

1. Take T.S. of the material 'A' (Pteridophyta), make a temporary slide and justify the identification with apt points. **10 M**
2. Take T.S. of the material 'B' (Gymnosperms), make a temporary slide and justify the identification with apt points. **10 M**
3. Describe the vegetative and floral characters of the material 'C' (Taxonomy of Angiosperms) and derive its systematic position. **10 M**
4. Identify the specimen and give specific reasons. **3x3=9 M**
  - D. (Pteridophyta)
  - E. (Gymnosperm)
  - F. (Herbarium Sheet identification)
5. Record + Herbarium & Field note book + Viva-voce **5 +3+3 = 11 M**

*V. Vasudharamani*  
30/12/23.

**IV Semester**  
**Course 3: Anatomy and Embryology of Angiosperms**  
Credits -3

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**I. Learning Objectives:** By the end of this course the learner has:

1. To know about various types of tissues in plants and their organization.
2. To obtain awareness on anomalous secondary growth in plants and economic value of woods.
3. To acquire knowledge on development of male and female gametophytes in plants.
4. To probe into embryogenesis in angiosperms.

**II. Learning Outcomes: On completion of this course students will be able to:**

1. Categorize various tissues and evaluate their role in plants.
2. Explain anomalous secondary growth in some plants and justify the value of timber plants.
3. Summarize the events in micro-sporogenesis and development of male gametophyte.
4. Discuss the events in mega-sporogenesis and development of female gametophyte.
5. Propose the incidents in embryogenesis of an angiospermic plant species.
6. Compile the aspects of developmental and reproductive biology in plants.

**III. Syllabus of Theory:**

**Unit – 1: Tissues in plants**

**8 Hrs.**

1. Meristematic tissues: Definition, classification, structure and functions.
2. Apical meristems: Generalised structure of shoot apex, theories on organization of Shoot Apical Meristem (SAM) - Apical cell theory, Tunica-Corpus theory and Histogen theory.
3. Permanent tissues (simple and complex).
4. A brief account of plant secretory tissues/cells.

**Unit-2: Anomalous growth in plants**

**10Hrs.**

1. Tissue systems—Epidermal, ground and vascular.
2. Anomalous secondary growth in root of *Beta vulgaris*
3. Anomalous secondary growth in stems of *Boerhaavia* and *Dracaena*
4. Study of timbers of economic importance - Teak, Red-sanders and Rosewood.

*V. S. Srinivasan*  
30/12/23.

**Unit-3: Anther and pollen****10Hrs.**

1. Anther: Structure and functions of anther wall, micro-sporogenesis, callose deposition and its significance.
2. Pollen wall structure, MGU (male germ unit) structure, NPC system; a brief account of Palynology and its scope; development of male gametophyte.
3. Pollen wall proteins; Pollen viability, storage and germination; abnormal features: pseudomonads, polyads, massulae, pollinia.

**Unit-4: Ovules, fertilization and endosperm****10Hrs.**

1. Structure and types of ovules, megasporogenesis; monosporic (*Polygonum*), bisporic (*Allium*) and tetrasporic (*Peperomia*) types of embryo sacs.
2. Outlines of pollination; self-incompatibility- basic concepts; methods to overcome self-incompatibility (mixed pollination, bud pollination, stub pollination).
3. Double fertilization in angiosperms – process and consequences.
4. Perisperm; endosperm – types (free nuclear, cellular, helobial and ruminant) and biological importance.

**Unit-5: Embryogeny and seeds****7Hrs.**

1. Embryogeny in dicot (*Capsella bursa-pastoris*)
2. Embryogeny in monocot (*Sagittariasagittifolia*).
3. Seed structure in monocot and dicot.
4. Importance of seed and seed dispersal mechanisms.
5. Polyembryony and apomixes: Introduction, classification, causes and applications.

**IV. Text Books:**

1. Pandey, B.P. (2013) College Botany, Volumes-II& III, S. Chand Publishing, New Delhi
2. Bhattacharya, K., G. Hait & Ghosh, A. K., (2011) A Text Book of Botany, Volume-II, New Central Book Agency Pvt. Ltd., Kolkata

**V. Reference Books:**

1. Esau, K. (1971) Anatomy of Seed Plants. John Wiley and Son, USA.
2. Fahn, A. (1990) Plant Anatomy, Pergamon Press, Oxford.
3. Cutler, D.F., T. Botha & D. Wm. Stevenson (2008) Plant Anatomy: An Applied

*V. Sundharani*  
30/12/23

Approach, Wiley, USA

4. Paula Rudall (1987) *Anatomy of Flowering Plants: An Introduction to Structure and Development*. Cambridge University Press, London
5. Bhojwani, S. S. and S. P. Bhatnagar (2000) *The Embryology of Angiosperms* (4th Ed.), Vikas Publishing House, Delhi.
6. Pandey, A. K. (2000) *Introduction to Embryology of Angiosperms*. CBS Publishers & Distributors Pvt. Ltd., New Delhi
7. Maheswari, P. (1971) *An Introduction to Embryology of Angiosperms*. McGraw Hill Book Co., London.
8. Johri, B.M. (2011) *Embryology of Angiosperms*. Springer-Verlag, Berlin

#### **VI. Suggested activities and evaluation methods:**

**Unit-1: Activity:** Microscopic observations on different tissues in plants and recording characteristics.

**Evaluation method:** Judgement of the report/seminar on comparative and contrasting features of various tissues in plants.

**Unit-2: Activity:** Visits to timber depots and furniture shops and making a report on various woods.

**Evaluation method:** Assessment of report submitted with data, photographs and summary.

**Unit-3: Activity:** Study of pollen structure, germination and viability in some local plant species.

**Evaluation method:** Evaluating the report/seminar presentation with collected data.

**Unit-4: Activity:** Group discussion/quiz on endosperm types and functions.

**Evaluation method:** Assessment of the best performing group.

**Unit-5: Activity:** Drawings of embryogeny in some angiosperms and making comparative report.

**Evaluation method:** Evaluating the best drawings and comparative report.

*V. Vasanthakumari*  
20/12/23

**IV Semester**  
**Course 3: Anatomy and Embryology of Angiosperms**  
**Credits -1**

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**Course Outcomes:** On successful completion of this practical course, student shall be able to:

1. Conduct dissections of various plant organs and study the internal structures by staining.
2. Look into the embryological characteristics from sex organs to seeds in angiosperms.

**Laboratory/field exercises:**

1. Observation of meristems in dicot and monocot plants.
2. Tissue organization in shoot apices using permanent slides.
3. Anomalous secondary growth in root of *Beta vulgaris*
4. Anomalous secondary growth in stems of *Boerhaavia* and *Dracaena*.
5. Study of anther and ovules using permanent slides/photographs.
6. Study of pollen germination and pollen viability.
7. Dissection and observation of embryo sac haustoria in *Santalum* or *Argemone*.
8. Structure of endosperm (nuclear and cellular) using permanent slides/photographs.
9. Dissection and observation of Endosperm haustoria in *Crotalaria* or *Coccinia*.
10. Developmental stages of dicot and monocot embryos using permanent slides /photographs.

*P. Vasantharaj*  
30/12/23.

**IV Semester**  
**Course 3: Anatomy and Embryology of Angiosperms**  
**Model paper for Practical Examination**

**Max. Time: 3 Hrs.**

**Max.Marks:50**

1. Take T.S. of the material 'A' (Anatomy), prepare a temporary slide and justify the identification with specific reasons. **10 M**
2. Write the procedure for the experiment 'B' (Embryology) and demonstrate the same. **10 M**
3. Take T.S. of the material 'C', prepare a temporary slide and justify the identification with specific reasons **10 M**
4. Identify the following with specific reasons. **4 x 3 = 12 M**
  - D. Anatomy permanent slide/specimen
  - E. Embryology permanent slide/specimen
  - F. Dicot/monocot embryo
  - G. Root secondary growth
5. Record + Viva-voce **5 + 3 = 8 M**

*V. Vasudharamani*  
30/12/23.



3. Ecological succession: Hydrosere and Xerosere.
4. Concepts of productivity: GPP, NPP and Community Respiration
5. Secondary production, P/R ratio and Ecosystems.

**Unit-3: Climate change-impacts**

**8Hrs.**

1. Soil degradation – causes, consequences and management strategies.
2. Deforestation, forest fires – causes, consequences and management strategies.
3. Global warming, ozone layer depletion, acid rains, ocean acidification – causes and effects.
4. Carbon foot prints and carbon credits; The Montreal and the Kyoto protocol.
5. Plant indicators and their role in environmental monitoring.

**Unit-4: Concepts of Biodiversity**

**10Hrs**

1. Biodiversity: Basic concepts, Convention on Biodiversity - Earth Summit.
2. Value of Biodiversity; types and levels of biodiversity and Threats to biodiversity
3. Biodiversity Hot spots in India: North Eastern Himalayas and Western Ghats.
4. Principles of conservation: IUCN threat-categories, RED data book
5. Role of NBPGR and NBA in the conservation of Biodiversity.

**Unit-5: Phytogeography**

**7 Hrs.**

1. Principles of Phytogeography, Distribution (wides, endemic, discontinuous species)
2. Endemism – types and causes.
3. Phytogeographic regions of India.
4. Vegetation types in Andhra Pradesh.

**IV. Text Books:**

1. Pandey, B.P. (2013) College Botany, Volumes- II & III, S. Chand Publishing, New Delhi
2. Bhattacharya, K., G. Hait & Ghosh, A. K., (2011) A Text Book of Botany, Volume II, New Central Book Agency Pvt. Ltd., Kolkata
3. N.S.Subrahmanyam & A.V.S.S. Sambamurty (2008) Ecology Narosa Publishing House, New Delhi
4. Sharma, P.D. (2012) Ecology and Environment. Rastogi Publications, Meerut, India.
5. U. Kumar (2007) Biodiversity: Principles & Conservation, Agrobios (India),

*Dr. U. Kumar*  
20/12/23

6. Mani, M.S (1974) Ecology & Biogeography of India Dr. W. Junk Publishers, The Hague

#### **V. Reference Books:**

1. Kormondy, Edward J. (1996) Concepts of Ecology, Prentice-Hall of India Private Limited, New Delhi
2. Begon, M., J.L. Harper & C.R. Townsend (2003) Ecology, Blackwell Science Ltd., U.S.A.
3. Eugene P. Odum (1996) Fundamentals of Ecology, Natraj Publishers, Dehradun
4. Kumar, H.D. (1992) Modern Concepts of Ecology (7th Edn.) Vikas Publishing Co., New Delhi.
5. Newman, E.I. (2000): Applied Ecology Blackwell Scientific Publisher, U.K.
6. Chapman, J.L. & M.J. Reiss (1992): Ecology - Principles & Applications. Cambridge University Press, U.K.
7. Kumar H.D. (2000) Biodiversity & Sustainable Conservation Oxford & IBH Publishing Co Ltd. New Delhi.
8. Cain, S.A. (1944) Foundations of Plant Geography Harper & Brothers, N.Y.
9. Good, R. (1997) The Geography of flowering Plants (2nd Edn.) Longmans, Green & Co., Inc., London & Allied Science Publishers, New Delhi

#### **VI. Suggested activities and evaluation methods:**

**Unit-1: Activity:** Field visit to local ecosystems and making a report on biotic and abiotic components and their interactions.

**Evaluation method:** Valuation of record of attendance and report submission with conclusions

**Unit- 2: Activity:** Case studies on population and community ecologies and making a comprehensive report

**Evaluation method:** Assessing the report and awarding grade

**Unit -3: Activity:** Case studies on global and local climatic changes and their impacts, preparing a comprehensive report.

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**Evaluation method:** Assessing the report and awarding grade.

**Unit- 4: Activity:** Making a survey in their locality to identify endangered and threatening species.

**Evaluation method:** Assessing the survey report and assigning a grade based on a rubric.

**Unit-5: Activity:** Collection of data on flora of their locality and preparing a project report.

**Evaluation method:** Assessing the project report and awarding a grade.

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**Semester -IV**

**Course 4: Plant Ecology, Biodiversity and Phytogeography**

Credits -1

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**I. Course Outcomes:** On successful completion of this practical course, student shall be able to:

1. Handle instruments used in ecological studies.
2. Perform experiments and collect data on autecology and synecology.
3. Identify various plant groups based on their morphological and anatomical adaptations.
4. Collect data on biodiversity and phytogeography.

**II. Laboratory/field exercises:**

1. Study of instruments used to measure microclimatic variables;
  - a. Soil thermometer,
  - b. Maximum and minimum thermometer,
  - c. Anemometer,
  - d. Rain gauze
  - e. Lux meter.
2. Visit to the nearest/local meteorology station where the data is being collected regularly and record the field visit summary for the submission in the practical.
3. Study of morphological and anatomical adaptations of any two hydrophytes.
4. Study of morphological and anatomical adaptations of any two xerophytes.
5. Quantitative analysis of herbaceous vegetation in the college campus for frequency, density and abundance
6. Identification of vegetation/various plants in college campus and comparison with Raunkiaer's frequency distribution law.
7. Find out the alpha-diversity of plants in an area
8. Mapping of biodiversity hotspots of the world and India.
9. Mapping of phytogeographical regions of the globe and India.

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**Semester -IV**  
**Course 4: Plant Ecology, Biodiversity and Phytogeography**  
**Model paper for Practical Examination**

**Max. Time: 3 Hrs.**

**Max.Marks:50**

1. Take T.S. of the material 'A' (hydrophyte), prepare a temporary slide and justify the identification with specific reasons. **10 M**
2. Take T.S. of the material 'B' (xerophyte), prepare a temporary slide and justify the identification with specific reasons. **10 M**
3. 'C' Demonstrate Raunkiaer's frequency distribution law **10 M**
4. Identify the following with specific reasons. **4 x 3 = 12 M**
  - D. Hydrophyte /Xerophyte permanent slide/specimen
  - E. Ecology instruments
  - F. Mapping of biodiversity hotspot/phytogeographic regions
  - G. Endemic /endangered plant
5. Record + Viva-voce **5 + 3 = 8 M**

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**Semester -V**  
**Course 5: Cell Biology and Genetics**  
Credits -3

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**I. Learning Objectives:** By the end of this course the learner has:

1. To look into the ultra-structure of plant cell and its organelle
2. To know the morphology and functions of chromosomes
3. To understand the principles of genetics, structure and functions of gene

**II. Learning Outcomes:** On completion of this course students will be able to:

1. Sketch the ultra-structural aspects of plant cell and its components.
2. Hypothesise the role of chromosomes in inheritance.
3. Justify the role of genes in inheritance of characters by descent.
4. Correlate the functions of the nucleic acid with their structure.
5. Explain the discoveries led to understand the fine structure of a gene.

**III. Syllabus of Theory:**

**Unit-1: Cell and its organelle**

**8 Hrs.**

1. Cell theory; prokaryotic vs eukaryotic cell; animal vs plant cell; a brief account on ultra-structure of a plant cell.
2. Ultra-structure of cell wall.
3. Ultra-structure of plasma membrane and various theories on its organization.
4. Polymorphic cell organelles (Plastids); ultra-structure of chloroplast, plastid DNA.
5. Ultrastructure of mitochondria, mitochondrial DNA.

**Unit-2: Chromosomes**

**8 Hrs.**

1. Prokaryotic vs eukaryotic chromosome; morphology of a eukaryotic chromosome.
2. Euchromatin and Heterochromatin; Karyotype and ideogram.
3. Brief account of chromosomal aberrations - structural and numerical changes
4. Organization of DNA in a chromosome (nucleosome and solenoid models).

**Unit-3: Mendelian and non-Mendelian Genetics**

**10 Hrs.**

1. Mendel's laws of inheritance. Incomplete dominance and co-dominance;

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2. Complementary, supplementary and duplicate gene interactions (plant-based examples are to be dealt).
3. A brief account of linkage and crossing over; Chromosomal mapping - 2 point and 3 point test cross.

**Unit-4: Structure and function of DNA**

**10 Hrs.**

1. Watson and Crick model of DNA. Brief account on DNA Replication (Semiconservative method).
2. Brief account on transcription, types and functions of RNA.
3. Genetic code and a brief account of translation.
4. Regulation of gene expression in prokaryotes - Lac Operon.

**Unit-5: Gene concept and Sex determination**

**9 Hrs.**

1. Evolution of gene concept: classical vs molecular concepts of gene.
2. Cis-Trans complementation test for functional allelism, gene as unit of function, mutation and recombination.
3. Pattern of sex determination in plants.
4. Allele and genotype frequencies, Hardy-Weinberg law.

**IV. Text Books:**

1. Pandey, B.P. (2013) College Botany, Volume-III, S. Chand Publishing, New Delhi
2. Ghosh, A.K., K.Bhattacharya&G. Hait (2011) A Text Book of Botany, Volume-III, New Central Book Agency Pvt. Ltd., Kolkata
3. A.V.S.S. Sambamurty (2007) Molecular Genetics, Narosa Publishing House, New Delhi
4. S. C. Rastogi (2008) Cell Biology, New Age International (P) Ltd. Publishers, New Delhi

**V. Reference Books:**

1. P. K. Gupta (2002) Cell and Molecular biology, Rastogi Publications, New Delhi
2. B. D. Singh (2008) Genetics, Kalyani Publishers, Ludhiana
3. Cooper, G.M. & R.E. Hausman (2009) The Cell – A Molecular Approach, A.S.M. Press, Washington
4. Becker, W.M., L.J. Kleinsmith & J. Hardin (2007) The World of Cell, Pearson, Education, Inc., New York

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5. De Robertis, E.D.P. & E.M.F. De Robertis Jr. (2002) Cell and Molecular Biology, Lippincott Williams & Wilkins Publ., Philadelphia
6. Robert H. Tamarin (2002) Principles of Genetics, Tata McGraw –Hill Publishing Company Limited, New Delhi.
7. Gardner, E.J., M. J. Simmons & D.P. Snustad (2004) Principles of Genetics, John Wiley & Sons Inc., New York
8. Micklos, D.A., G.A. Freyer & D.A. Cotty (2005) DNA Science: A First Course, I.K.International Pvt. Ltd., New Delhi

#### **VI. Suggested activities and evaluation methods:**

**Unit-1: Activity:** Group discussion on different types of cells and their components.

**Evaluation method:** Identifying the best group or performer and giving a reward.

**Unit-2: Activity:** Observation of chromosomal aberrations in *Allium cepa* root cells exposed to industrial effluent/ heavy metals

**Evaluation method:** Validation of report and assigning a grade based on a rubric.

**Unit-3: Activity:** Solving the problems on classical genetics.

**Evaluation method:** Assessing the accuracy in solving the problems and awarding a grade.

**Unit-4: Activity:** Making models of nucleic acids.

**Evaluation method:** Selecting the best and assigning a grade.

**Unit-5: Activity:** Making a comprehensive report on sex determination in plants by collecting scientific literature.

**Evaluation method:** Validation of report and assigning a grade based on a specified point scale.

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**V Semester**  
**Course 5: Cell Biology and Genetics**  
Credits -1

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**I. Course Outcomes:** On successful completion of this practical course, student shall be able to:

1. Identify the stages of mitotic and meiotic cell divisions.
2. Infer the structure and functions of nucleic acids.
3. Predict the consequences of a particular genetic condition.

**II. Laboratory/field exercises:**

1. Study of ultra-structure of plant cell and its organelles using electron microscopic photographs /models.
2. Demonstration of mitosis in *Allium cepa*/*Aloe vera* roots using squash technique.
3. Observation of various stages of mitosis in permanent slides.
4. Demonstration of meiosis in P.M.C.s of *Allium cepa* flower buds using squash technique.
5. Observation of various stages of meiosis in permanent slides.
6. Study of structure of DNA and RNA molecules using models.
7. Solving problems on monohybrid, dihybrid, back and test crosses.
8. Solving problems on gene interactions (at least one problem for each of the gene interactions in the syllabus).
9. Chromosomes mapping using problems of 3- point test cross data.

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V Semester

Course 5: Cell Biology and Genetics

Max. Time: 3 Hrs.

Max. Marks: 50

1. Make a cytological preparation of given material 'A' (mitosis or meiosis in Onion) by squash technique, report any two stages, draw labelled diagrams and write the reasons. **15 M**
2. Solve the given Genetic problem (Dihybrid cross/ Interaction of genes/ 3-point test cross) 'B' and write the conclusions. **10 M**
3. Identify the following and justify with apt reasons. **3 x 5 = 15 M**
  - C. Cell Biology (Cell organelle)
  - D. Genetics (DNA/RNA)
  - E. Cell division stages
4. Record + Viva-voce **7 + 3 = 10 M**

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**V Semester**  
**Course 6: Plant Physiology and Metabolism**  
Credits -3

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**I. Learning Objectives:** By the end of this course the learner has:

1. To understand the concept of Soil-Plant-Atmosphere continuum based on plant-water relations.
2. To study the anabolic and catabolic processes in plants.
3. To understand the role of plant growth regulators on growth, development and flowering.

**II. Learning Outcomes:** On successful completion of this course, the students will be able to:

1. Comprehend the importance of water in plant life and mechanisms for transport of water and solutes in plants.
2. Explain the role of minerals in plant nutrition and their deficiency symptoms.
3. Interpret the role of enzymes in plant metabolism.
4. Hypothesise the light reactions and carbon assimilation processes responsible for synthesis of food in plants.
5. Analyze the biochemical reactions in relation to Nitrogen and lipid metabolisms.
6. Evaluate the physiological factors that regulate growth, development and flowering in plants.

**III. Syllabus of Theory:**

**Unit – 1: Plant-Water relations**

**8 Hrs.**

1. Importance of water to plant life, physical properties of water, diffusion, imbibition, osmosis. Water potential, osmotic potential, pressure potential.
2. Absorption and lateral transport of water; Ascent of sap
3. Transpiration: stomata structure and mechanism of stomatal movements ( $K^+$  ion flux).
4. Mechanism of phloem transport; source-sink relationships.

**Unit – 2: Mineral nutrition, Enzymes and Respiration**

**10 Hrs.**

1. Essential macro and micro mineral nutrients and their role in plants; symptoms of mineral deficiency
2. Absorption of mineral ions; passive and active processes.

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3. Characteristics, nomenclature and classification of Enzymes. Mechanism of enzyme action, enzyme kinetics.
4. Respiration: Aerobic and Anaerobic; Glycolysis, Krebs cycle; electron transport system, mechanism of oxidative phosphorylation.

**Unit – 3: Photosynthesis and Photorespiration** **10 Hrs.**

1. Photosynthesis: Photosynthetic pigments, absorption and action spectra; Red drop and Emerson enhancement effect
2. Concept of two photosystems; mechanism of photosynthetic electron transport and evolution of oxygen; photophosphorylation
3. Carbon assimilation pathways (C3, C4 and CAM).
4. Photorespiration - C2 pathway

**Unit – 4: Nitrogen and lipid metabolism** **9 Hrs.**

1. Nitrogen metabolism: Biological nitrogen fixation – asymbiotic and symbiotic nitrogen fixing organisms. Nitrogenase enzyme system.
2. Lipid metabolism: Classification of Plant lipids, saturated and unsaturated fatty acids.
3. Anabolism of triglycerides,  $\beta$ -oxidation of fatty acids, Glyoxylate cycle.

**Unit – 5: Plant growth - development** **8Hrs.**

1. Growth and Development: Definition, phases and kinetics of growth.
2. Physiological effects of Plant Growth Regulators (PGRs) - auxins, gibberellins, cytokinins, ABA, ethylene and brassinosteroids.
3. Physiology of flowering: Photoperiodism, role of phytochrome in flowering.
4. Seed germination and senescence; physiological changes during seed germination.

**IV. Text Books:**

1. Pandey, B.P. (2013) College Botany, Volume-III, S. Chand Publishing, New Delhi
2. Ghosh, A. K., K. Bhattacharya & G. Hait (2011) A Text Book of Botany, Volume III, New Central Book Agency Pvt. Ltd., Kolkata

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## V. Reference Books:

1. Aravind Kumar & S.S. Purohit (1998) Plant Physiology – Fundamentals and Applications, Agro Botanica, Bikaner
2. Datta, S.C. (2007) Plant Physiology, New Age International (P) Ltd., Publishers, New Delhi
3. Hans Mohr & P. Schopfer (2006) Plant Physiology, Springer (India) Pvt. Ltd., New Delhi
4. Hans-Walter Heldt (2005) Plant Biochemistry, Academic Press, U.S.A.
5. Hopkins, W.G. & N.P.A. Huner (2014) Introduction to Plant Physiology, Wiley India Pvt. Ltd., New Delhi
6. Noggle Ray & J. Fritz (2013) Introductory Plant Physiology, Prentice Hall (India), New Delhi
7. Pandey, S.M. & B.K. Sinha (2006) Plant Physiology, Vikas Publishing House, New Delhi
8. Salisbury, Frank B. & Cleon W. Ross (2007) Plant Physiology, Thomsen & Wadsworth, Australia & U.S.A
9. Sinha, R.K. (2014) Modern Plant Physiology, Narosa Publishing House, New Delhi
10. Taiz, L. & E. Zeiger (2003) Plant Physiology, Panima Publishers, New Delhi.
11. Verma, V. (2007) Text Book of Plant Physiology, Ane Books India, New Delhi.

## VI. Suggested activities and evaluation method

**Unit-1: Activity:** Observe and tabulate the water content of different plant parts and justify the importance of the water based on the morphological nature.

**Evaluation method:** Assess the report and assign the grade points based on a rubric.

**Unit-2 Activity:** Survey report on various inorganic and organic fertilizers available in the local markets.

**Evaluation method:** Assess the record and award the grades on a specified point scale.

**Unit-3 Activity:** Identify the C4 plants from their locality and make a report.

**Evaluation method:** Assessing the clarity, organization, and effectiveness of the report's presentation and communication based on a rubric.

**Unit-4 Activity:** Group discussion on various Nitrogen fixing microbes.

**Evaluation method:** Assessing the group members' ability to think critically and analyze the topic being discussed.

**Unit-5 Activity:** A critical assignment on photoperiodic responses in plants in their locality.

**Evaluation method:** Evaluating the logical coherence and reasoning in the assignment.

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**V Semester**  
**Course 6: Plant Physiology and Metabolism**  
Credits -1

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**I. Course outcomes:** On successful completion of this practical course, students shall be able to:

1. Conduct lab and field experiments pertaining to plant physiology.
2. Estimate the quantities and qualitative expressions using experimental results and calculations
3. Interpret the factors responsible for growth and development in plants.

**II. Laboratory/field exercises:**

1. Determination of osmotic potential of plant cell sap by plasmolytic method using *Rhoeo/Tradescantia* leaves.
3. Calculation of stomatal index and stomatal frequency of a mesophyte, a hydrophyte and a xerophyte.
3. Determination of rate of transpiration using Cobalt chloride method / Ganong's potometer (at least for a dicot and a monocot).
4. Effect of temperature on membrane permeability by colorimetric method.
5. Study of mineral deficiency symptoms using plant material/photographs.
6. Demonstration of amylase enzyme activity and study the effect of substrate and Enzyme concentration.
7. Separation of chloroplast pigments using paper chromatography technique.
8. Demonstration of Polyphenol oxidase enzyme activity (Potato tuber or Apple fruit)
9. Anatomy of C3, C4 and CAM leaves.
10. Estimation of protein by biuret method/Lowry method.
11. Minor experiments – Osmosis, Arc-auxometer, ascent of sap through xylem, cytoplasmic streaming

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V Semester

Course 6: Plant Physiology and Metabolism Model Question Paper for Practical Examination

Max. Time: 3 Hrs. Max. Marks: 50

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1. Conduct the experiment 'A' (Major experiment), write aim, principle, material and apparatus/equipment, procedure, tabulate results and make conclusion. **15 M**
  2. Demonstrate the experiment 'B' (Minor experiment), write the principle, procedure and give inference. **10 M**
  3. Identify the following with apt reasons. **3 x 5 = 15 M**
    - C. Plant water relations / Mineral nutrition
    - D. Plant metabolism
    - E. Plant growth and development
  4. Record + Viva-voce **7 + 3 = 10 M**

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B.Sc HONOURS DEGREE EXAMINATIONS UG  
COMMON MODEL QUESTION PAPER

Time:3 Hours

Max.Marks:75

SECTION-A

Answer any FIVE of the following (Marks:  
5 x 5 marks = 25 marks)

- 1.
- 2.
- 3.
- 4.
- 5.
- 6.
- 7.
- 8.

SECTION-B

Answer any FIVE of the following  
(Marks: 5 x 10 marks = 50 marks)

UNIT-I

9. (a)  
or  
(b)

UNIT-II

10. (a)  
Or  
(b)

UNIT-III

11. (a)  
Or  
(b)

UNIT-IV

12. (a)  
Or  
(b)

UNIT-V

13. (a)  
Or  
(b)

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