



**VIJAYANAGARA SRIKRISHNADEVARAYA  
UNIVERSITY, BALLARI**

**Syllabus for  
Ph.D. Course Work syllabus in  
Botany**

**(With effect from Academic Year 2019-20)**

**Department of Studies in Botany  
Vijayanagara Sri Krishnadevaraya University,  
Jnana Sagara Campus Ballari-583105  
Karnataka, India**

## SYLLABUS FOR Ph.D COURSE WORK

Sl. No	Name of the Course	Contact Hours per week	No of Credits per paper	Continuous Assessment	Course End Examination	Total	Examination Hours
1	<b>Course- I</b> Research Methodology	04	04	30	70	100	03
2	<b>Course – II :</b> Research and Publication Ethics (RPE)	02	02	15	35	50	02
3	<b>Course – III:</b> Cognate/Core Subject	04	04	30	70	100	03
4	<b>Course – IV:</b> Field of Specialization (Ph.D candidates are required to study one of the courses depending upon their field of specialization)	04	04	30	70	100	03
<b>Course Sub Total</b>			<b>14</b>	<b>105</b>	<b>245</b>	<b>350</b>	<b>-</b>
5	Viva vice	-	-	-	-	50	-
<b>Grand total</b>						<b>400</b>	<b>-</b>

**COURSE -I: RESEARCH METHODOLOGY** **52 Hrs**

**UNIT– I Research methodology** **12 hrs**

Introduction, current trends, current area focus, objectives of scientific research. Research report, components of a scientific research article, reading and understanding a research article. Presentation skills. Topic Selection: Problem identification; Criteria for prioritizing problems for research. Work Plan; Major components and outline of the different phases in a research process; Summary of the major components of a research proposal; Impact factor, citation index, submission of research articles, Fieldwork; Writing a research report. Literature review: Uses of literature review; Source of information; Organization of information on index cards.

**UNIT– II Tools & techniques to design experiments** **14 hrs**

Sterilization, Extractions, Chromatography, spectroscopy, separation of proteins, DNA, RNA, blotting techniques, centrifugation, electrophoresis, PCR. Biostatistics Mean, mode, median, standard deviation and standard error, student 't test, ANOVA, SPSS. Bioinformatics: BLAST, FASTA, Clustal-W, phylogenetic tree, PHYLIP.

**UNIT-III Basic laboratory techniques** **14 hrs**

Chromatography techniques: Centripetal & Centrifugal force; Factors affecting Sedimentation, Sedimentation coefficient and Sedimentation constant, principle, types - paper chromatography, Thin layer chromatography (TLC), column chromatography, High performance liquid chromatography (HPLC), Gas chromatography (GC). Radiolabeling techniques. Histology, histochemistry and immunohistochemistry, Electrophoresis: Agarose gel electrophoresis, polyacrylamide gel electrophoresis, blotting techniques, Polymerase chain reaction techniques- gene amplification, reverse transcription. Real time PCR techniques, gene cloning. Microtome.

**UNIT-IV Basics and fundamentals of Computers** **12 hrs**

MS word, MS Excel, Powerpoint, Internet explorer (Google chrome, Mozilla firefox), Bioinformatics- Databases- NCBI, EMBL. Pairwise sequence alignment, Multiple sequence alignment, phylogenetic tree construction using Phylip softwares.

**COURSE-II: RESEARCH AND PUBLICATION ETHICS (RPE)** **30 hrs**

**THEORY**

- **RPE 01: PHILOSOPHY AND ETHICS (3 HRS)**
  1. Introduction to philosophy: definition, nature and scope, concept, branches
  2. Ethics: definition, moral philosophy, nature of moral judgments and reactions
- **RPE 02: SCIENTIFIC CONDUCT (5 HRS)**
  1. Ethics with respect to science and research
  2. Intellectual honest and research integrity
  3. Scientific misconducts: falsification, fabrication, and plagiarism (FFP)

4. Redundant publications: duplicate and overlapping publications, salami slicing
5. Selective reporting and misrepresentation of data.
- **RPE 03: PUBLICATION ETHICS (7 HRS)**
  1. Publication ethics: definition, introduction and importance
  2. Best practices/standards setting initiatives and guidelines: COPE, WAME, etc.
  3. Conflicts of interest
  4. Publication misconduct: definition, concept, problems that lead to unethical behavior and vice versa, types
  5. Violation of publication ethics, authorship and contributor ship
  6. Identification of publication misconduct, complaints and appeals
  7. Predatory publishers and journals

#### **PRACTICE**

- **RPE 04: OPEN ACCESS PUBLISHING (4 HRS)**
  1. Open access publications and initiatives
  2. SHERPA/RoMEO online resource to check publisher copyright and self-archiving policies.
  3. Software tool to identify predatory publications developed by SPPU
  4. Journal finder/ journal suggestion tools viz. JANE, Elsevier Journal Finder, Springer Journal Suggester, etc.
- **RPE 05: PUBLICATION MISCONDUCT (4 HRS)**
  - A. Group Discussions (2 hrs)**
    1. Subject specific ethical issues, FFP, authorship
    2. Conflicts of interest
    3. Complaints and appeals: examples and fraud from India and abroad
  - B. Software tools (2 hrs)**  
Use of plagiarism software like Turnitin, Urkund and other open source software tools.
- **RPE 06: DATABASES AND RESEARCH METRICS (7 HRS)**
  - A Databases (4 hrs)**
    1. Indexing databases
    2. Citation databases: Web of Science, Scopus, etc.
  - B. Research Metrics (3 hrs)**
    1. Impact Factor of journal as per journal citation report, SNIP, SJR, IPP, Cite Score.
    2. Metrics: h-index, g index, i10 index, altmetrics

**COURSE WORK -III: COGNATE /CORE SUBJECT - BOTANY 52 hrs**

**Unit-I Medicinal & Aromatic plants 12 hrs**

Medicinal plants classification. Cryptogams as medicine: Properties and active compounds of Algae, Fungi, Lichens, Bryophytes, Pteridophytes and Gymnosperms. Pharmacognosy: Raw drug analysis, microscopic, macroscopic characteristics, preliminary chemical analysis (*Senna*, *Withania*, *Rauwolfia*). Phytochemistry: Classification and properties of alkaloids, steroids, terpenoids, lectins, non-protein amino acids.

**Unit-II Plant pathology 14 hrs**

History and development of Plant Pathology Disease concept in plants: Disease classification, Causal factors - biotic and abiotic, disease diagnosis, Koch's postulates. Principles of plant

disease control: Regulatory Methods: Plant quarantine regulation, inspection and certification. Physical Methods: Heat and cold treatment (Hot water, Hot air, Radiation treatment). Chemical Methods: Prophylactants and systemic chemicals. Methods of fungicide application. Seed and soil treatment. Control of post-harvest diseases.

**Unit III Genetics, molecular biology and genetic engineering** **14 hrs**

Introduction, Pre Mendelian, Mendelian and Post Mendelian genetics, gene interaction, discovery of genetic material, fine structure of gene. Overlapping genes, split genes, cryptic genes, regulation of gene expression in prokaryotes and eukaryotes. Genetic code, Restriction enzymes, DNA ligase, Kinase, Klenow fragment, Reverse transcriptase, T4 Ligase.

**Unit –IV Plant systematics** **12 hrs**

Introduction, ICBN, importance of herbarium, flora writing, monographs/ revisions, preparations of dichotomous key, field notes, taxonomy in relation with anatomy, embryology, chemotaxonomy, cytology. Molecular taxonomy: identification of molecular markers, RFLP, RAPD, AFLP. DNA Libraries: Construction of genomic library, c-DNA Library.

**COURSE - IV (A) FIELD OF SPECIALIZATION - PHYTOCHEMISTRY AND MOLECULAR BIOLOGY** **52 hrs**

**Unit-I: Techniques for, isolation and characterizations of phytoconstituents:** **12 hrs**

Introduction, principle and applications of different extraction and isolation methods: Soxhlet extraction, reflux condenser, Thin layer chromatography, column chromatography, high performance liquid chromatography, gas chromatography techniques, Mass spectroscopy and NMR.

**Unit-2: Molecular Biology and genetic engineering techniques:** **14 hrs**

Introduction, genomic DNA isolation, plasmid DNA isolation by alkaline lysis method, RNA isolation and protein purification techniques. Principle of separation techniques -agarose gel electrophoresis and SDS-PAGE. Restriction digestion, ligation, Northern, Southern and western blotting techniques. SDS-Poly-acrylamide gel electrophoresis, gene cloning.

**Unit-3: Bioinformatics:** **14 hrs**

Definition and scope and applications, Major Bioinformatics Resources: EMBL, DDBJ, GenBank, SwissProt, PDB. Pairwise sequence alignments: Sequence similarity, identity, and homology. Global and local alignment, Sequence alignment, pairwise and multiple sequence alignment, local and global alignment, BLAST, FASTA, CLUSTAL-W. Application of multiple sequence alignment.

**Unit-4: Pharmacology techniques** **12 hrs**

Introduction: definition, historical perspective, branches and scope of the subject of pharmacology and its relation with other medical disciplines. Routes of drugs' administration; advantages and disadvantages of different routes.

**COURSE -IV (B) FIELD OF SPECIALIZATION - PLANT SYSTEMATICS AND PHYTOTHERAPY RESEARCH** **52 hrs**

**Unit -I Plant systematics:** **12 hrs**

Introduction, ICBN, importance of herbarium, flora writing, monographs/ revisions, preparations of dichotomous key, field notes, taxonomy in relation with anatomy, embryology, chemotaxonomy, cytology. Molecular taxonomy: identification of molecular markers, RFLP, RAPD, AFLP. DNA Libraries: Construction of genomic library, c-DNA Library.

**Unit- II Isolation and identification of phytocompounds** **14 hrs**

Techniques of extraction- soxhlet, maceration. Properties and role of solvents in extraction. Extraction, processing, composition and uses of aromatic essential oils. Separation, Purification and identification of phytocompounds-Paper, Thin layer chromatography, Column chromatography, Gas chromatography, high performance liquid chromatography. NMR, Mass spectroscopy. Nano biotechnology-production, its role in drug delivery.

**Unit-III Bioscreening of isolated compounds: in vitro pharmacology** **14 hrs**

Thin-Layer Chromatography (TLC)-Bioautography, MIC, MBC, MFC, cell toxicity studies; Adenosine Triphosphate (ATP) Bioluminescence Assay , Flow Cytometry. Anti cancer - Stained Viable Cells Assay, Dye Exclusion Assay. Methods Based on Metabolic Activity- Tetrazolium reduction assay, Resazurin assay, Protease Viability Marker Assay.

**Unit-IV Validation of natural compounds for hepatoprotective –** **12 hrs**

Antiobesity, anticancer, antidiabetic, antimicrobial properties. Clinical pharmacology: Clinical study design, clinical trials, Phase I, Phase II, Phase III and Phase IV studies, design documentation, presentation and interpretation.

**References:**

1. Research Methods for the Biosciences. Holmes, Moody & Dine. Oxford University Press.
2. Experimental Design for the Life Sciences. Ruxton & Colegrave. Oxford University Press.
3. Experimental Design for Biologists. David J. Glass. Cold Spring Harbor Laboratory.
4. Research Methodology – C.R.Kothari
5. Photosynthesis- physical mechanisms and chemical patterns: Clayton R K: Cambridge Univ. Press, 1992
6. Enzymatic reaction mechanisms: Walsh C T: W H Freeman, New York, 1979,
7. Encyclopedia of plant physiology, New series, 1, Springer, New York.
8. Plant physiology: Lincoln Taiz and Eduardo Zeiger: Sinaur Assoc. Inc. Sunderland Massachusetts 1998.
9. Cell and Molecular Biology: Lewin J Klein smith and Valerie M Kish
10. Cell and Molecular Biology- Concept and Experiments 2nd Ed: Gerald Karp
11. Genetics: Denial J Fairbanks
12. Molecular Biology of Gene: J P Watson

13. Chawla, H. S. (2002). Introduction to plant Biotechnology Oxford and IBH Publishing Co. Pvt. Ltd. New Delhi.
14. Dixan. R. A. and Ganzales, R. A. (1994). Plant Cell Culture – A practical Approach. Oxford
15. Razdhan, M. K. (2003). Introduction to plant tissue culture 2<sup>nd</sup> edition: oxford and IBH Publishing Co. New Delhi.
16. Gambarg, O. L. and Phillips (1996). Plant Cell, Tissue and Organ Culture. Fundamental method, Naraosa Publishing House New Delhi.
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18. Evans Et al., (1983). Hand Book of Plant Cell Culture. Vol.-I. Macmillan Publishing Co. New York.
19. Kirtikar K.R. and Basu, B.D. 1932 Indian Medicinal Plants.
20. Nadkarni, A.K. 1954 Indian Materia Medica Vol I & II
21. Sivarajan, V.V. and Indira, B. 1994. Ayurvedic drugs and their plant sources. Oxford & IBH publishing Co, New Delhi.
22. Trease, G, E. and Evans, W.L. 1983. Pharmacognosy 12<sup>th</sup> ed. Bailliere Tindall, London.
23. Vaidya, B.1982. Some controversial drugs in Indian Medicine. Chaukamba Orientalia, Varanasi.
24. Harborne, J. 1984. Phytochemical Methods. Ed. Chapman & Hall, London
25. Mann, J., Davidson, R.S. Hobbs, J.B., Benthorpe, D.V. and Harborne Natural products, Longman Scientific and Technical Co, Essex.
26. Smith, P. M.1976. The chemotaxonomy of plants Edward Arnold, London.
27. Introduction to pharmacology by Mannfred A Hollinger, CBC Press Maheshwari P. (1950). An introduction to Embryology of angiosperms. McGrew Hill, New York.
28. Bhojwani SS and bhatnagar SP (2000). The embryology of Angiosperms (4<sup>th</sup> revised and enlarged edition). Vikas Publishing house, new Delhi
29. Raghav V (1986). Embryogenesis in angiosperms- A developmental and experimental studies. Cambridge University Press, new York, USA.
30. Raghavan V. (1987). Molecular Biology of flowering plants Cambridge University Press New York USA.
31. Bioinformatics: A Practical Guide to the Analysis of Genes and Proteins. By: Andreas D. Baxevanis (Ed), B. F. Francis Ouellette (Ed). Edition: 3<sup>rd</sup> edition, October 2004. Publisher: Wiley, John & Sons, Incorporated. ISBN: 0471478784
32. Bioinformatics Basics: Applications in Biological Science and Medicine. By: Hooman Rashidi, Lukas K. Buehler. Edition: 2<sup>nd</sup> edition, May 2005. Publisher: CRC Press/Taylor & Francis Group. ISBN: 0849312833



**VIJAYANAGARA SRI RISHNADEVARAYA UNIVERSITY, BALLARI**

**DEPARTMENT OF STUDIES IN BOTANY**

## **Ph.D. Course Work Question Paper Pattern**

**Paper title:**

Time: 3 hours

Marks: 70

Instructions: All sections are compulsory

### **Section-A**

Answer any **Five** of the following questions in about one and half page each.  $5 \times 5 = 25$

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

### **Section-B**

Answer any **Three** of the following questions in about three pages.  $3 \times 10 = 30$

- 8.
- 9.
- 10.
- 11.
- 12.

### **Section-C**

Answer any **One** of the following questions in about Four pages.  $1 \times 15 = 15$

- 13.
- 14.