VIJAYANAGARA SRI KRISHNADEVARAYA UNIVERSITY
Jnanasagara campus, Bellary-583105

Bachelor of Science in Botany

V semester Syllabus

Effective from Academic Year 2023-24
(Revised as per NEP-2020)

VIJAYANAGARA SRI KRISHNADEVARAYA UNIVERSITY
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B.Sc. (Botany) Programme with effect from 2021-22

THIRDYEAR; SEMESTER-5										
Objective: Real time Learning & Ability to solve complex problems that are ill-structured										
Category	**Course code**	**Title of the Paper**	**Marks**			**Teaching hours/week**			**Credit**	**Duration of exams (Hrs)**
			IA	**SEE**	**Total**	**L**	**T**	**P**		
DSC5	**21BSC5C5BOL**	**Plant Morphology and Taxonomy**	40	60	100	4	-	-	4	3
	21BSC5C5BOP	**Plant Morphology and Taxonomy**	25	25	50	-	-	4	2	3
DSC6	**21BSC5C6BOL**	**Genetics and Plant Breeding**	40	60	100	4	-	-	4	3
	21BSC5C6BOP	**Genetics and Plant Breeding**	25	25	50	-	-	4	2	3
Another Department course (Theory+Practical)	Another Department code	Another Department Course Title **(Theory)**	40	60	100	4	-	-	4	3
	Another Department code	Another Department Course Title **(Lab)**	25	25	50	-	-	4	2	3
Another Department course (Theory+Practical)	Another Department code	Another Department Course Title **(Theory)**	40	60	100	4	-	-	4	3
	Another Department code	Another Department Course Title **(Lab)**	25	25	50	-	-	4	2	3
SEC4	**--**	**Employability Skills/Cyber Security**	-	-	-	2	-	2	3	3
Semester Total									**27**	

5th Semester Syllabus for B.Sc. in BOTANY

Plant Morphology and Taxonomy (Theory)

Program Name	**B.Sc. in BOTANY**	Semester	**Fifth**
Course Title	**Plant Morphology and Taxonomy (Theory)**		
Course Code:	**DSC5**-21BSC5C5BOL	No. of Credits	**04**
Contact hours	**56 Hours**	Duration of Exam	**2 hours**
Internal Assessment	**40 marks**	Semester end exam	**60 marks**

Course Pre-requisite(s):

Course Outcomes (COs): After the successful completion of the course, the student will be able to:

CO1. Understand the main features in Angiosperm evolution
CO2. Identify, classify, and describe a plant in scientific terms, and develop dichotomous keys.
CO3. Interpret the rules of ICN in botanical nomenclature.
CO4. Classify Plants Systematically and recognize the importance of herbarium and Virtual Herbarium, Evaluate the Important herbaria and botanical gardens.
CO5. Recognition of locally available angiosperm families and plants and economically important plants.
CO6: Appreciate human activities in the conservation of useful plants from the past to the present.

Contents	**56 hrs**
Unit 1: Morphology	**12 hrs**
Root: General introduction, Modification for storage, Mechanical support, and Respiration **Stem:** General introduction and Their modifications for various functions. **Leaf:** General introduction, types, Phyllotaxy, stipules, and Their modifications for various functions. **Flower:** Types. Structure and variations of the flower. Floral diagram and floral formula **Inflorescence:** Types. Structure and variations of the flower. **Fruits:** Types. **Seeds:** Types and structure of dicot and monocot seeds.	
Unit 2: Introduction to Taxonomy	**10 hrs**
Introduction: History, objectives, scope, and relevance of Taxonomy. **Systems of classification**: Artificial, Natural, and Phylogenetic; a brief account of Linnaeus' Bentham& Hooker's, Engler and Prantl's system and APG IV System (2016).- Merits and demerits of classification. **Taxonomic literature:** Floras, Monographs, Revisions, Journals. **Herbaria and Botanical Gardens:** Herbarium- techniques of preparation of herbarium, importance of herbarium, Important herbaria of world and India. Botanical Gardens and their importance, Important Botanical Gardens of the world and India	

Virtual herbarium; E-flora; Documentation.	
Unit 3: Taxonomic Hierarchy	**08 hrs**
Concepts of Taxonomical Hierarchy: Concept of taxa (family, genus, species); Categories and taxonomic hierarchy; Species concepts (biological, morphological, evolutionary). Modes of speciation. Problems with species concepts. **Botanical Nomenclature:** Principles and rules (ICN); Latest code –brief account, Brief account of Ranks of taxa, Type concept (Typification), Rule of priority, Author citation., valid publication, rejection of names, principle of priority and its limitations; Names of hybrids/cultivated species.	
Unit 4: Plant Identification, Description, and diagnostic features of angiosperm families	**12 hrs**
Plant identification: Taxonomic dichotomous keys; intended (yolked) and bracketed keys. (brief account only). **Plant descriptions**: Technical term used for the description of vegetative and reproductive parts of the following families.	
Study of the diagnostic features of Angiosperm families and their economic importance (with suitable examples): Annonaceae, Brassicaceae, Malvaceae, Rutaceae, Anacardiaceae, Fabaceae (with sub Families), Myrtaceae, Cucurbitaceae, Apiaceae, Rubiaceae, Asteraceae, Apocynaceae, Solanaceae, Acanthaceae, Lamiaceae, Amaranthaceae, Euphorbiaceae, Liliaceae, Arecaceae and Poaceae. **Plant Taxonomic Evidences:** from palynology embryology, cytology, phytochemistry, and molecular data. Field inventory.	
Unit 5:	**13 hrs**
Biometrics, Numerical Taxonomy; Phenetics and Cladistics: Characters; Variations; OTUs, character weighting, and coding; Cluster analysis; Phenograms, cladograms (definitions and differences). **Phylogenetic Systematics:** Terms and concepts (primitive and advanced, homology and analogy, parallelism and convergence, monophyly, Paraphyly, polyphyly, clades, synapomorphy, symplesiomorphy, apomorphy, lineage sorting, serial homology etc). **Origin and evolution of angiosperms;** Evolution of angiosperms; Methods of illustrating evolutionary relationship (phylogenetic tree, cladogram). **Molecular taxonomy:** With respect to DNA sequences of chloroplast genes (*atp*B, rbcL, ITS, trnL etc) and one nuclear gene (nuclear ribosomal 18s DNA).	

Program Name	**B.Sc. in BOTANY**	Semester	**Fifth**
Course Title	**Plant Morphology and Taxonomy (Practical)**	Practical Credits	**02**
Course Code	**DSC5-** 21BSC5C5BOP	Contact Hours	**4 Hours**
Internal Assessment	**25 Marks**	Semester end exam	**25 Marks**

Practical Content

1. **Morphology**: Study of root, stem and leaf structure and modifications. Study of inflorescence types. Study of flower and its parts, Study of fruits. Floral diagram and floral formula. **06 hrs**

2. Study of families mentioned in theory with at least two examples for each family and makes suitable diagrams, describe them in technical terms (Description, V.S. flower, section of ovary, floral diagram/s, floral formula/e, and systematic position according to Bentham & Hooker's system of classification) and identify up to species using the flora. **24 hrs**
3. Construction of plant phylogenetic trees using various loci (*atp*B, rbcL, ITS, trnL etc.) with various phylogenetic methods (Neighbor Joining, Maximum Likelihood, etc). **06 hrs**

4. Identify plants/plant products of economic importance belonging to the families mentioned in the syllabus; with binomial, family, and morphology of useful parts. Cotton, Mango, Red gram, Green gram, Horse gram, Black gram, Bengal gram, Indigo, Brinjal, Tomato, Chilly, Tamarind, Bitter gourd, *Luffa*, Asfoetida, Cumin, Coriander, Coffee, Rubber, Tapioca, Ricinus, Ginger, Turmeric, Coir, Arecanut, Rice, Wheat, Ragi, Sugarcane *Annona muricata Catharanthus roses*, *Rauvolfia serpentaina, Justicia adhatoda*, *Vitex nigundo* and *Leucas aspera* **14 hrs**

5. **Field visit**: Local or outside area/ Botanical Garden/ tribal settlements minimum 3 to 5 days.

6. **Submission:** Record book, Tour report, and Herbarium (Preparation of 10 properly identified herbarium specimens; mounting of a properly dried and pressed specimen of any common plants from your locality with herbarium label).

References

1	Baker. H.G. 1970. Plant and Civilization, Wadsworth Publishing Company.
2	Colton C.M. 1997. Ethnobotany – Principles and applications. John Wiley and sons –Chichester
3	Cotton, C.M. 1996. Ethnobotany – Principles and Applications. Wiley and Sons
4	Datta S C, *Systematic Botany*, 4th Ed, Wiley Estern Ltd., New Delhi, 1988.
5	Eames A. J. - *Morphology of Angiosperms* - Mc Graw Hill, New York.
6	Hall, B.G. (2011). *Phylogenetic Trees Made Easy: A How-To Manual*. Sinauer Associates, Inc. USA
7	Heywood - *Plant taxonomy* - Edward Arnold London.
8	Jeffrey C .J. and A. Churchil - *An introduction to taxonomy* – London.

9	Jeffrey, C. (1982). An Introduction to *Plant Taxonomy*. Cambridge University Press, Cambridge
10	Judd, W.S., Campbell, C.S., Kellogg, E.A., Stevens, P.F., Donogue, M.J., 2002. *Plant Systematics: A Phylogenetic approach*, 2nd edition. Sinauer Associates, Inc., USA.
11	Lawrence - *Taxonomy of Vascular Plants* - Oxford & I B H, New Delhi.
12	Manilal, K.S. and M.S. Muktesh Kumar 1998. *A Handbook on Taxonomy Training*. DST, New Delhi.
13	Manilal, K.S. and A.K. Pandey, 1996. *Taxonomy and Plant Conservation*. C.B.S. Publishers & Distributors, New Delhi.
14	Manilal, K.S. 2003. *Van Rheede'sHortusMalabaricus. English Edition*, with Annotations andModern Botanical Nomenclature. (12 Vols.) University of Kerala, Trivandrum.
15	Naik V.N., *Taxonomy of Angiosperms*, 1991. Tata Mcgraw-Hill Pub. Co. Ltd., New Delhi.
16	Pandey, S. N, and S.P. Misra (2008)-*Taxonomy of Angiosperms*- Ane Books India, New Delhi.
17	Radford A B, W C Dickison, J M Massey & C R Bell, *Vascular Plant Systematics*, 1974,Harper & Row Publishers, New York.
18	Singh G.2012. *Plant systematics: Theory and Practice*. Oxford and IBH, Pvt. Ltd., New Delhi.
19	Singh V. & Jain - *Taxonomy of Angiosperms* - Rastogi Publications, Meerut.
20	Sivarajan V. V - *Introduction to Principles of taxonomy* - Oxford &I B H New Delhi.
21	Any local/state/regional flora published by BSI or any other agency.

GENERAL PATTERN OF THEORY QUESTION PAPER

(60 marks for semester end Examination with 2 hrs duration)

Part-A

1. Question number 1 and sub-questions (a) to (j) carries 1 mark each. Answer all the sub-questions 10 marks

Part-B

2. Question number 02- 07 carries 05 Marks each. Answer any 04 questions: 20 marks

Part-C

3. Question number 08-12 carries 10 Marks each. Answer any 03 questions : 30 marks

(Minimum 1 question from each unit and 10 marks question may have sub-questions for 7+3 or 6+4 or 5+5 if necessary)

Total: 60 Marks

Note: Proportionate weightage shall be given to each unit based on number of hours prescribed.

SCHEME OF PRACTICAL EXAMINATION

(Distribution of marks): 25 marks for the Semester end examination

1. Identify, classify and describe the specimen A & B taxonomically	6 Marks
2. Identify the given specimen C with the help of Key using Flora	4 Marks
3. Write the floral diagram and floral formal of the given specimen D	2 Marks
4. Identification of Specimen/slides E, F and G	6 Marks
5. Viva Voce	2 Marks
6. Submission (Journal / Record +Study Tour Report)	5 Marks

Total 25 marks

General instructions:

Q1. Give specimen from Dicotyledons (A) and Monocotyledons (B) Q2.
Give specimen from family they studied (C)
Q3. Give specimen from family they studied (D)
Q4. Specimen /Slides/ materials from Root/Stem/ Leaf/ Inflorescence (E), Flower/Fruit (F) and Economic importance (G)
Q5. Viva
Q6. Submission (Journal/ Record + Study Tour Report)

Note: Same Scheme may be used for IA (Formative Assessment) examination

Genetics and Plant Breeding (Theory)

Program Name	**B.Sc. in BOTANY**	Semester	**Fifth**
Course Title	**Genetics and Plant Breeding (Theory)**		
Course Code:	**DSC6 -** 21BSC5C6BOL	No. of Credits	**04**
Contact hours	**56 Hours**	Duration of Exam	**2 hours**
Internal Assessment	**40 marks**	Semester end exam	**60 marks**

Course Pre-requisite (s):

Course Outcomes (COs): After the successful completion of the course, the student will be able to:

CO1.Understanding the basics of genetics and plant breeding

CO2.Ability to identify, calculate, and describe crossing over, allelic generations, and frequencies of recombination.

CO3.Interpret the results of mating and pollinations.

CO4.ClassifyPlantpollination methods

CO5.Recognition of modes of inheritance of traits/ phenotypes and Phenotype-genotype correlation.

Contents	**56 Hrs**
Unit 1: Mendelian Genetics and Gene interactions	**10 hrs**
Mendelian Genetics: History; Monohybrid cross, dihybrid cross. Probability and Pedigree analysis; **Extension of Mendelism**: Incomplete dominance and codominance; Multiple alleles, Lethal alleles, Epistasis, Supplementary genes, complimentary genes, Pleiotropy, Recessive and Dominant traits, Penetrance and Expressivity.	
Unit 2: Inheritance	**08 hrs**
Principles of inheritance: Chromosome theory of inheritance; Autosomes and sex chromosomes; Polygenic inheritance. **Extrachromosomal Inheritance**: Chloroplast mutation, Variegation in Four o'clock plant; Mitochondrial mutations in yeast. **Quantitative inheritance:** Concept, mechanism, examples of inheritance of Kernel colour in wheat, Monogenic vs polygenic Inheritance.	
Unit 3: Linkage and Crossing over	**08 hrs**
Linkage, crossing over and chromosome mapping. Linkage and crossing over-Cytological basis of crossing over; Recombination frequency, two factor and three factor crosses; Interference and coincidence; Numerical based on gene mapping; Sex Linkage.	
Unit 4: Chromosomal Variations and Mutation	**14hrs**

Variation in chromosome number and structure: Gene mutations Types of mutations; Molecular basis of Mutations; Mutagens – physical and chemical (Base analogs, deaminating, alkylating and intercalating agents); Detection of mutations: ClB method. Role of Transposons in mutation. DNA repair mechanisms. Fine structure of gene (Population and Evolutionary Genetics, Allele frequencies, Genotype frequencies, Hardy-Weinberg Law, role of natural selection, mutation, genetic drift. Genetic variation and Speciation.	
Unit 5: Plant Breeding	**16 hrs**
Plant Breeding: Introduction and objectives. Breeding systems: modes of reproduction in crop plants. Important achievements and undesirable consequences of plant breeding. Methods of crop improvement **Introduction**: Centers of origin and domestication of crop plants, plant genetic resources; Acclimatization; **Selection methods**: For self-pollination, cross pollination and vegetative Propagation in plants; **Hybridization**: For self, cross and vegetative propagation in plants – Procedure, advantages and limitations. **Inbreeding depression and heterosis**: History, genetic basis of inbreeding depression and heterosis; Applications. Crop improvement and breeding Role of mutations; Polyploidy; Distant hybridization and role of biotechnology in crop improvement.	

Program Name	**B.Sc. in BOTANY**	Semester	**Fifth**
Course Title	**Genetics and Plant Breeding (Practical)**	Practical Credits	**02**
Course Code	**DSC6 -**21BSC5C6BOP	Contact Hours	**4 Hours**
Internal Assessment	**25 Marks**	Summative Assessment	**25 Marks**

Practical Content

Practical: Genetics

1. Mendel's laws through seed ratios. Laboratory exercises in probability.
2. Chromosome mapping using point test cross data.
3. Pedigree analysis for dominant and recessive autosomal and sex-linked traits.
4. Incomplete dominance and gene interaction through seed ratios (9:7, 9:6:1, 13:3, 15:1, 12:3:1, 9:3:4).
5. Study of aneuploidy: Down's, Klinefelter's and Turner's syndromes.
6. Photographs/Permanent Slides showing the Translocation Ring, Laggards, and Inversion Bridge.

Practical: Plant breeding:

1. Reproductive of biology, self, and cross-pollinated plants; Vegetative reproduction
2. Hybridization: Emasculation, bagging, pollination, and production of hybrids and pollen fertility
3. Origin, distribution, and centers of diversity of crop plants: Wheat, Sorghum, Rice, Chilly Sugarcane, Cotton, Potato, coffee, Sunflower, and groundnut

References

1	Acquaah, G. (2007). Principles of Plant Genetics &Breeding.NewJearsey, U.S.: Blackwell Publishing.
2	Singh, B.D. (2005). Plant Breeding: Principles and Methods, 7th edition. New Delhi, Delhi: Kalyani Publishers.
3	Chaudhari, H.K. (1984). Elementary Principles of Plant Breeding, 2nd edition. New Delhi, Delhi: Oxford – IBH.
4	Gardner, E.J., Simmons, M.J., Snustad, D.P. (1991). Principles of Genetics, 8th edition. New Delhi, Delhi: John Wiley & sons
5	Griffiths, A.J.F., Wessler, S.R., Carroll, S.B., Doebley, J. (2010). Introduction to Genetic Analysis, 10th
	edition. New York, NY: W.H. Freeman and Co.
6	Klug, W.S., Cummings, M.R., Spencer, C.A. (2012). Concepts of Genetics, 10th edition. San Francisco, California: Benjamin Cummings
7	Raven, F.H., Evert, R. F., Eichhorn, S.E. (1992).Biology of Plants. New York, NY: W.H. Freeman and Co.
8	Welsh, J. R. (1981). Fundamentals of Plant Genetics and Breeding. John Wiley and Sons, New York.
9	Poehlman, J.M. (1987). Breeding Field Crops, 3rd Ed. AVI Publishing Co. Inc., Westport, Connecticut
10	Chopra, V.L. (2000). Plant Breeding: Theory and Practice 2nd Ed. Oxford & IBH, New Delhi.

GENERAL PATTERN OF THEORY QUESTION PAPER

(60 marks for semester end Examination with 2 hrs duration)

Part-A

1. Question number 1 and sub-questions (a) to (j) carries 1 mark each. Answer all the sub-questions 10 marks

Part-B

2. Question number 02- 07 carries 05 Marks each. Answer any 04 questions: 20 marks

Part-C

3. Question number 08-12 carries 10 Marks each. Answer any 03 questions : 30 marks

(Minimum 1 question from each unit and 10 marks question may have sub-questions for 7+3 or 6+4 or 5+5 if necessary)

Total: 60 Marks

Note: Proportionate weightage shall be given to each unit based on number of hours prescribed.

SCHEME OF PRACTICAL EXAMINATION

(Distribution of marks): 25 marks for the Semester end examination

1. Perform the emasculation / pollen viability / fertility of the given sample **A** 5 Marks
2. Calculate the recombinant frequency and state the order of gene from the given data **B** 4 Marks
4. Identification of Specimen/slides/ Photographs **C, D** and **E** 6 Marks
5. Viva Voce 5 Marks
6. Genetic Problem (Mendelian Ratio/Gene interactions) 5 Marks

Total 25 marks

General instructions:

Q1 Material Cassia// Hibiscus/ etc (A)

Q2. Mapping using one point / two point test cross data (B)

Q3. Down's, Klinefelter's and Turner's syndromes, Translocation Ring, Laggards and Inversion Bridge (C, D and E)

Q5. Viva

Q6. Submission (Journal/ Record)

Note: Same Scheme may be used for IA (Formative Assessment) examination