BENGALURU CITY UNIVERSITY

CHOICE BASED CREDIT SYSTEM

(Semester Scheme with Multiple Entry and Exit Options for Under Graduate Course)

Syllabus for Botany
(V & VI Semester)

2023-24

Proceedings of the meeting of BoS (UG) in Botany held on 29th & 30th August 2023 at the Department of Biochemistry, Central College Campus, Bangalore City University, Bengaluru – 560 001

Venue: Department of Biochemistry, Central College Campus, Bangalore City University, Bengaluru – 560 001

Date: 30/08/2023 Time: 11:00 AM

Agenda:

1. To finalize the syllabus for V and VI Semester B.Sc. Botany (UG) (CBCS) NEP-2020 for approval.
2. To approve the panel of examiners recommended for the examinations of 2023-24.
3. To recommend and approve the constitution of BoE for the academic year 2023-24.

Members Present		Signature
1. Smt. Zaiba Nishaath Banu	Member	
2. Dr. Mallikarjuna P.B.	Member	
3. Dr. B. L. Manjula	Member	
4. Smt. K. R. Kavitha	Member	K.R.Kavitha 30/8/2023
5. Smt. Chandrakala S	Member	
6. Smt. K.S. Shailaja	Member	ABSENT
7. Dr. L. Rajanna	Chairman	

Members Absent

1. Dr. Jenifer Lolitha Member
2. Smt. N. Sarvamangala Member

MINUTES OF THE MEETING OF BoS (UG) IN BOTANY

Chairman welcomed the members of the BoS (UG) to the meeting and the agenda was placed for discussion.

a). Discussed and finalized the syllabus for theory and practical of **V** and **VI** Semester B.Sc., Botany (CBCS), question paper pattern, blue print of question paper Formative assessment and Scheme of valuation for NEP programme to be implemented from the academic year 2023-24.

b). The panel of Examiners was approved and recommended for UG Examination for the academic year 2023-24.

c). Recommendations were made to constitute BoE for the academic year 2023-24.

d). The Chairman was authorized to change / incorporate the corrections as per the directions of Bangalore City University.

The meeting ended with a vote of thanks by the Chairman.

Dr. B. L. Manjula, Associate Professor, SJRC – Race Course road, Blore-1

Smt. Chandrakala Shivakumar, Asst. Professor, SJRCW, Rajajinagar, B'lore-10

Zaiba Nushath Bano Associate Professor, Vijaya College

RVRd - Zaiba

Dr. K.R.Kavitha. Professor, Nrupathunga Univ. B'lore-1

K.R.Kavitha 20/9/2023

Dr. P.B.Mallikarjuna, Professor, GFGC Yelahanka

Dr. L. RAJANNA
Professor
Dept. of Botany
Bangalore University
Jnanabharathi Campus,
Bangalore - 560056.

Chairman BOS (UG)
BCU

Karnataka State Higher Education Council

BOTANY Syllabus Framing Committee

Sl No	Name	Designation	Signature
1.	Prof. G R Naik, Vice Chancellor, Garden City University, Bengaluru	Chairman	
2.	Dr. A. H. Rajasab, Pro Vice Chancellor, KNB University, Kalaburagi	Member	
3.	Dr. G.R. Janardhana, Professor, University of Mysore, Mysuru	Member	
4.	Dr. L. Rajanna, Professor, Bangalore University, Bengaluru	Member	
5.	Dr. Y. L. Krishnamurthy Professor, Kuvempu University, Shivamogga	Member	
6.	Dr. K. Kotresha Professor, Karnataka Science College, Karnatak University, Dharwad	Member	
7.	Dr. Govindappa M, Professor, Davangere University, Davangare	Member	
8.	Shri. M. N. Mallikarjunaiah, Associate Professor, Mandya University, Mandya	Member	
9.	Dr. Abdul Khayum, Associate Professor, Government Women's College, Kolar	Member	
10.	Dr. P. Sharanappa Professor, Hassan University, Hassan	Member	
11.	Dr. Mamtha, Associate Professor, Government First Grade College, Bengaluru	Member	
12.	Dr. Lathadevi Karikal, Associate Professor, Sharanabasaveshwara University, Kalaburagi	Member	
13.	Dr. Kiran Kumar S. Associate Professor, Garden City University, Bengaluru	Member	
14.	Smt. Akshata Chandra Special Officer Karnataka State Higher Education Council	Member convener	

COURSE PATTERN AND SCHEME OF EXAMINATION FOR B.SC. / B.SC. (HONS.) AS PER NEP (2023-24 ONWARDS)																
SUBJECT : BOTANY																
Sl. No	Semester	Title Of The Paper	Teaching Hours	Hours/Week		Examination pattern Max. and Min. Marks/Paper						Duration of exam (hours)		Total marks/ paper	Credits	
						Theory			Practical							
				Theory	Practical	Max.	Min.	IA	Max.	Min.	IA	Theory	Practical		Theory	Practical
1	V	CORE SUBJECT	56	4	4	60	21	40	25	09	25	2 1/2	4	150	4	2
		CORE SUBJECT	56	4	4	60	21	40	25	09	25	2 1/2	4	150	4	2
		SKILL ENHANCEMENT COURSE	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2	VI	CORE SUBJECT	56	4	4	60	21	40	25	09	25	2 1/2	4	150	4	2
		CORE SUBJECT	56	4	4	60	21	40	25	09	25	2 1/2	4	150	4	2
		SKILL ENHANCEMENT COURSE	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Government of Karnataka

BOTANY Curriculum

B. Sc. BOTANY – V Semester

Plant Morphology and Taxonomy (Theory)

Program Name	**B.Sc. in BOTANY**	Semester	**V**
Course Title	**Plant Morphology and Taxonomy (Theory)**		
Course Code:	**DSC – BOT-C9 - T**	No. of Credits	**04**
Contact hours	**56 Hours**	Duration of SEA/Exam	**2½ hours**
Formative Assessment Marks	**40**	Summative Assessment Marks	**60**

Course Pre-requisite(s):

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

CO1. Understanding the main features in Angiosperm evolution
CO2. Ability to identify, classify and describe a plant in scientific terms, thereby, Identification of plants using dichotomous keys. Skill development in identification and classification of flowering plants.
CO3. Interpret the rules of ICN in botanical nomenclature.
CO4. Classify Plant Systematic 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. Appreciation of human activities in conservation of useful plants from the past to the present.

Contents	**56 Hrs**
Unit 1:	**14 hrs**
Morphology of Root, Stem and Leaf. Their modifications for various functions. Inflorescence – types. Fruits–types. Structure of Flower - Floral diagram and floral formula. **Introduction to Taxonomy**: History, objectives, scope and relevance of Taxonomy **Systems of classification**: Artificial, Natural and Phylogenetic; brief account of Linnaeus', Bentham & Hooker's, Engler and Prantl's system and APG IV System (2016) - Merits and demerits of classifications. **Taxonomic literature:** Floras, Monographs and Journals. **Herbaria and Botanical gardens:** Important herbaria and botanical gardens of the world (Royal Botanical Garden, Kew, England) and India (National Botanical Garden, Calcutta). Role of botanical gardens. Technique of Herbarium Preparation **Virtual herbarium:** E-flora; Documentation.	

Unit 2:	**14 hrs**
Plant identification: Taxonomic dichotomous keys; intended (yolked) and bracketed keys. (Brief account only). **Plant descriptions**: Common Terminologies used for description of vegetative and reproductive parts of the following families **Study of the diagnostic features of Angiosperm families:** Annonaceae, Brassicaceae, Rutaceae, Fabaceae (Papilionoideae, Ceasalpinoideae and Mimosaideae), Cucurbitaceae, Apiaceae, Rubiaceae, Asteraceae, Lamiaceae, Euphorbiaceae, Orchidaceae, Commelinaceae, and Poaceae. **Plant Taxonomic Evidences:** from palynology, embryology, cytology, phytochemistry and molecular data.	
Unit 3:	**14 hrs**
Taxonomic Hierarchy: Concept of taxa (family, genus, species); Categories and taxonomic hierarchy; Species concepts (biological, morphological and evolutionary).Rank less system of phylogenetic systematics **Botanical Nomenclature:** Principles and rules (ICN); Latest code –brief account, Brief account of Ranks of taxa, Type concept (Typification), Rule of priority, effective and valid publication, Author citation., rejection of names, Nomenclature of hybrids/cultivated species.	
Unit 4:	**14 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;** Co-evolution of angiosperms and animals; Methods of illustrating evolutionary relationship (phylogenetic tree, cladogram). **Molecular taxonomy:** DNA sequences of chloroplast gene (rbcL)	

Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs 1-15)

Course Outcomes (COs) / Program Outcomes (POs)	Program Outcomes (POs)														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15

Pedagogy: Teaching and learning, Seminar, Assignments

Formative Assessment for Theory	
Assessment Occasion/ type	**Marks**
Attendance	10
Test	10
Assignments	10
Seminar	10
Total	**40 Marks**
Formative Assessment as per NEP guidelines are compulsory	

B. Sc. BOTANY – V Semester

Plant Morphology and Taxonomy (Practical)

Program Name	**B. Sc. in BOTANY**	Semester	**V**
Course Title	**Plant Morphology and Taxonomy (Practical)**	Practical Credits	**02**
Course Code	**DSC – BOT - C10 - P**	Contact Hours	**52 Hours**
Formative Assessment	**25 Marks**	Summative Assessment	**25 Marks**

Practical Content

1. Study of root, stem and leaf structure and modifications. Study of inflorescence types. Study o flower and its parts, Study of fruits. Floral diagram and floral formula.

08 hrs

2. Study of families mentioned in theory preferably two examples from each family and make 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.

28 hrs

3. Identify plants/plant products of economic importance belonging to the families mentioned in the syllabus; with binomial, family and morphology of useful parts. Red gram, Green gram, Horse gram, Black gram, Bengal gram, Indigo, Tamarind, Bitter gourd, *Luffa*, Asafoetida, Cumin, Coriander, Coffee, Rubber, Tapioca, Ricinus, Rice, Wheat, Ragi, Sugarcane, *Annona muricata*, *Ruta graveolens*, Mustard and *Leucas aspera*

16 hrs.

4. **Field visit**: Local or outside area/ Botanical garden/ tribal settlements minimum 1 to 3 days.
5. **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).

Pedagogy: Teaching and learning, conducting experiments, field visits and Identification skills

Formative Assessment for Practical	
Assessment Occasion/ type	**Marks**
Attendance	05
Test	10
Field visit (3 marks) and tour report (2 marks)	05
Submission (Economic Botany)	05
Total	**25 Marks**
Formative Assessment as per NEP guidelines are compulsory	

GENERAL PATTERN OF THEORY QUESTION PAPER

(60 marks for semester end Examination with $2^{1}/_{2}$ hours duration)

Part-A

1. Question number 1-06 carries 2 marks each. Answer any 05 questions: 10 marks

Part-B

2. Question number 07- 11 carries 05 Marks each. Answer any 04 questions: 20 marks

Part-C

3. Question number 12-15 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

Time: 4 hours **Max. Marks: 25**

1. Identify, classify and describe the specimen A & B taxonomically	6 Marks
2. Identify the given specimen C with technical description.	4 Marks
3. Draw the floral diagram and write the floral formula of the given specimen D	2 Marks
4. Identification of Specimen E, F and G	6 Marks
5. Submission (Herbarium)	2 Marks
6. Submission (Record)	5 Marks

General instructions:

Q1. Specimen from Dicotyledons (A) and Monocotyledons (B)
Q2. Specimen from family they studied (C)
Q3. Specimen from family they studied (D)
Q4. Specimen/materials from Root/Stem/ Leaf/ Inflorescence (E), Fruit (F) and Economic importance (G)
Q5. Submission of 4 herbarium
Q6. Submission (Record)

References	
1	Baker. H.G. 1970. Plant and Civilization, Wadsworth Publishing Company.
2	Datta S C, *Systematic Botany*, 4th Ed, Wiley Estern Ltd., New Delhi, 1988.
3	Eames A. J. - *Morphology of Angiosperms* - Mc Graw Hill, New York.
4	Hall, B.G. (2011). *Phylogenetic Trees Made Easy: A How-To Manual*. Sinauer Associates, Inc. USA
5	Heywood - *Plant taxonomy* - Edward Arnold London.
6	Jeffrey C .J. and A. Churchil - *An introduction to taxonomy* – London.
7	Jeffrey, C. (1982). An Introduction to *Plant Taxonomy*. Cambridge University Press, Cambridge
8	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.
9	Lawrence - *Taxonomy of Vascular Plants* - Oxford & I B H, New Delhi.
10	Manilal, K.S. and M.S. Muktesh Kumar 1998. *A Handbook on Taxonomy Training*. DST, New Delhi.
11	Manilal, K.S. and A.K. Pandey, 1996. *Taxonomy and Plant Conservation*. C.B.S. Publishers & Distributors, New Delhi.
12	Manilal, K.S. 2003. *Van Rheede'sHortusMalabaricus. English Edition*, with Annotations andModern Botanical Nomenclature. (12 Vols.) University of Kerala, Trivandrum.
13	Naik V.N., *Taxonomy of Angiosperms*, 1991. Tata Mcgraw-Hill Pub. Co. Ltd., New Delhi.
14	Pandey, S. N, and S.P. Misra (2008)-*Taxonomy of Angiosperms*- Ane Books India, New Delhi.
15	Radford A B, W C Dickison, J M Massey & C R Bell, *Vascular Plant Systematics*, 1974,Harper & Row Publishers, New York.
16	Singh G.2012. *Plant systematics: Theory and Practice*. Oxford and IBH, Pvt. Ltd., New Delhi.
17	Singh V. & Jain - *Taxonomy of Angiosperms* - Rastogi Publications, Meerut.
18	Sivarajan V. V - *Introduction to Principles of taxonomy* - Oxford &I B H New Delhi.
19	Any local/state/regional flora published by BSI or any other agency.

B. Sc. BOTANY – V Semester

Genetics and Plant Breeding (Theory)

Program Name	**B.Sc. in BOTANY**	Semester	**V**
Course Title	**Genetics and Plant Breeding (Theory)**		
Course Code:	**DSC – BOT-C11 - T**	No. of Credits	**04**
Contact hours	**56 Hours**	Duration of SEA/Exam	**$2^{1}/_{2}$ hours**
Formative Assessment Marks	**40**	Summative Assessment Marks	**60**

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.Abilitytoidentify, calculate and describe crossing over, allelic generations and frequencies of recombination.

CO3.Interprettheresults of mating and pollinations.

CO4.ClassifyPlantpollination methods

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

Contents	**56 Hrs**
Unit 1:	**14 hrs**
Mendelian genetics – Introduction, History, Laws and concepts Non-Mendelian genetics - Allelic (Incomplete Dominance and Co-dominance) and non-allelic gene interactions (complementary, supplementary factors, dominant and recessive epistasis) and Multiple alleles. Extra chromosomal inheritance Chloroplast mutation: variegation in Four o'clock plant; Mitochondrial mutations in yeast.	
Unit 2:	**14 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; Sex Determination in plants - *Melandrium* Variation in chromosome number and structure Gene mutations –Types, Molecular basis of Mutations; Mutagens – physical and chemical (Base analogs, deaminating, alkylating and intercalating agents); Detection of mutations Fine structure of gene Population Genetics - Allele frequencies, Genotype frequencies, Hardy-Weinberg Law, role of natural selection and mutation Evolutionary Genetics – Genetic drift. Genetic variation and Speciation.	

Unit 3:	**14 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 - Plant introduction, primary and secondary Plant genetic resources - Acclimatization Selection methods: For self-pollinating and cross pollinating crops Types of vegetative propagation in plants Hybridization – Types, Procedure, advantages and limitations.	
Unit4:	**14 hrs**
Quantitative inheritance: Concept, mechanism, examples of inheritance of Kernel colour in Wheat, Monogenic vs Polygenic inheritance. 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.	

Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs 1-15)

Course Outcomes (COs) / Program Outcomes (POs)	**Program Outcomes (POs)**														
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**

Pedagogy: Teaching and learning, Seminar, Assignments and skills of Hybridization

Formative Assessment for Theory	
Assessment Occasion/ type	**Marks**
Attendance	10
Test	10
Assignments	10
Seminar	10
Total	**40 Marks**
Formative Assessment as per NEP guidelines are compulsory	

B. Sc. BOTANY – V Semester

Genetics and Plant Breeding (Practical)

Course Title	**Genetics and Plant Breeding (Practical)**	Practical Credits	**02**
Course Code	**DSC – BOT – C12 - P**	Contact Hours	**52 Hours**
Formative Assessment	**25 Marks**	Summative Assessment	**25 Marks**

Practical Content

Plant breeding:

1. Reproductive biology of self and cross pollinating plants
2. Vegetative reproduction – Cutting, Budding, , grafting and layering
3. Hybridization: Emasculation, bagging, pollination and production of hybrids
4. Pollen fertility – Tetrazolium test

Genetics:

6. Mendel's laws through seed ratios (monohybrid and dihybrid crosses)
7. Incomplete dominance and gene interaction through seed ratios (9:7, 9:6:1, 13:3).
8. Incomplete dominance and gene interaction through seed ratios (15:1, 12:3:1, 9:3:4).
9. Study of aneuploidy: Down's, Klinefelter's and Turner's syndromes (Photocopies).
10. Photographs showing Translocation Ring, Laggards and Inversion Bridge.

Pedagogy: Teaching and learning, conducting experiments, field / Lab.visits

Formative Assessment for Practical	
Assessment Occasion/type	**Marks**
Attendance	05
Test	10
Submission of solved problems	05
Submission of potted plant/Vegetative propagation	05
Total	**25 Marks**
Formative Assessment as per NEP guidelines are compulsory	

GENERAL PATTERN OF THEORY QUESTION PAPER

(60 marks for semester end Examination with $2^1/_2$ hrs duration)

Part-A

1. Question number 1-06 carries 2 marks each. Answer any 05 questions: 10 marks

Part-B

2. Question number 07- 11 carries 05 Marks each. Answer any 04 questions: 20 marks

Part-C

3. Question number 12-15 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

Time: 4 hours **Max. Marks: 25**

1. Perform the emasculation / pollen viability / fertility of the given sample **A** 5 Marks
2. Solve the genetic problem **B** 4 Marks
3. Identification of specimen/ Photographs **C, D** and **E** 6 Marks
4. Viva Voce 5 Marks
5. Submission (Record) 5 Marks

General instructions:

Q1 Material Cassia / Hibiscus/ etc., (A)
Q2. Genetic problem (B)
Q3. Down's, Klinefelter's and Turner's syndromes any one for C, Translocation Ring, Laggards and Inversion Bridge any one for D and vegetative propagation for E
Q4. Viva voce
Q5. Submission (Record)

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.

B. Sc. BOTANY – VI Semester

CELL AND MOLOECULAR BIOLOGY (THEORY)

Program Name	**B.Sc. in BOTANY**	Semester	**VI**
Course Title	**Cell and Molecular Biology (Theory)**		
Course Code:	**DSC-BOT- C13-T**	No. of Credits	**04**
Contact hours	**56 Hours**	Duration of SEA/Exam	**$2^{1}/_{2}$ hours**
Formative Assessment Marks	**40**	Summative Assessment Marks	**60**

Course Pre-requisite (s):

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

CO5. Understanding of Cell metabolism, chemical composition, physiochemical and functional organization of organelles.

CO6. Contemporary approaches in modern cell and molecular biology.

CO7. To study the organization of the cell, cell organelles and biomolecules (i.e. Protein, carbohydrate, lipid and nucleic acid).

CO8. To gain knowledge on the activities in which the diverse macromolecule and microscopic structures inhibiting the cellular world of life are engaged.

CO9. To understand the various metabolic processes such as respiration, photosynthesis etc., which are important for life.

Contents	**56 Hrs**
UNIT 1	**14 hrs**
Plant cell – Ultrastructure and its components **Cell wall –** Types, composition and functions **Biological membranes** – Types, composition and transport (Plasma membrane, nuclear membrane and E R membrane) **Plant cell organelles** – Structure and function (Nucleus, Vacuole, mitochondrion and chloroplast) Cytoskeleton	
UNIT 2	**14 hrs**
Chromosome Biology – Types and structural organization of eukaryotic chromosomes (up to nucleosome model) **Types of Chromosomes** – Normal, giant and supernumerary chromosomes **Cell cycle** – Phases of eukaryotic cell cycle, check points and role of protein kinases **Cell division** – Mitosis and meiosis and its significance **Karyotype** – Types and significance. Programmed cell death (PCD).	
UNIT 3	**14 hrs**
Molecular Biology – Historical perspectives, DNA is the genetic material (Griffith's, Harshey and Chase experiments) **Nucleic acids** – DNA structure, composition, types and the mechanism of replication A brief account of DNA repair mechanism **RNA** – Structure, composition and types Central dogma of Molecular biology, genetic code – Salient features Gene expression in prokaryotes (Transcription and translation)	

UNIT 4	14 hrs
Gene concept, Genomics and proteomics Gene regulation- Lac operon concept Epigenetics – Gene editing, DNA methylation, Sn/mi RNAs and Ribozymes Genomic organization in Eukaryotes Recombinant DNA technology – A brief account Introduction to Bioinformatics and its applications	

Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs 1-15)

Course Outcomes (COs) / Program Outcomes (POs)	Program Outcomes (POs)														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Core competency															
Critical thinking															
Analytical reasoning															
Research skill															
Team work															

Formative Assessment for Theory	
Assessment Occasion/type	**Marks**
Attendance	10 Marks
Test	10 Marks
Assignments	10 Marks
Seminar	10 Marks
Total	40 Marks

Pedagogy: Teaching, learning seminar and assignment skills

B. Sc. BOTANY – VI Semester

CELL AND MOLOECULAR BIOLOGY (Practical)

Course Title	**Cell and Molecular Biology (Practical)**	Practical Credits	**2**
Course Code	**DSC-BOT - C14-P**	Contact Hours	**52 Hours**
Formative Assessment	**25 Marks**	Summative Assessment	**25 Marks**

Practical Content

1. Study of plant cell structure with the help of epidermal peel mount of Onion/Rhoeo/ Crinum
2. Study of cell and its organelles with the help of electron micrographs
3. Study of different stages of mitosis and meiosis (Onion/Rhoeo/Crinum)
4. Study of Karyotype using Camera Lucida/chart
5. Salivary gland chromosome
6. Isolation of cell organelle – Chloroplast
7. **Molecular Biology** - Isolation of DNA by CTAB method (Cauliflower)
8. Estimation of RNA - by Orcinol method

GENERAL PATTERN OF THEORY QUESTION PAPER

(60 marks for semester end Examination with $2^1/_2$ hrs duration)

Part-A

1. Question number 1-06 carries 2 marks each. Answer any 05 questions: 10 marks

Part-B

2. Question number 07- 11 carries 05 marks each. Answer any 04 questions: 20 marks

Part-C

3**.** Question number 12-15 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

Cell and Molecular Biology

Time: 04 Hours **Max. Marks: 25**

1. Preparation of squash/smear of material **A**, Identify, sketch and label any two stages with reasons 06 marks
2. Isolation of DNA/Estimation of RNA of material **B** 06 marks
3. Identify the slides **C** and **D** 04 marks
4. Viva-voce 03 marks
5. Submission (Record + 4 slides) (4 + 2) 06 marks

General instructions:

Q1. Onion/Rhoeo/ Crinum plant **(A)**
Q2. Cauliflower/RNA sample **(B)**
Q3. Slides from Mitosis or meiosis **(C)** and Karyotype/Salivary gland chromosome **(D)**
Q4. Viva-voce
Q5. Submission (Record + 4 Slides)

Pedagogy: Teaching and learning, Seminar, Assignments, etc

Formative Assessment for Practical	
Assessment	**Marks**
Attendance	05 Marks
Test	15 Marks
viva	05 Marks
Total	**25 Marks**

	References
1	1. Cooper, G.M., Hausman, R.E. (2009). The Cell: A Molecular Approach, 5th edition. Washington DC: ASM Press & Sunderland, Sinauer Associates, MA
	2. Karp. G. (2010). Cell Biology, 6th edition. New Jersey, U.S.A.. John Wiley & Sons.
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B. Sc. BOTANY – VI Semester

PLANT PHYSIOLOGY AND PLANT BIOCHEMISTRY (THEORY)

Program Name	**B. Sc. in BOTANY**	Semester	**VI**
Course Title	**Plant Physiology and Plant Biochemistry (Theory)**		
Course Code:	**DSC-BOT-C15-T**	No. of Credits	**04**
Contact hours	**56 Hours**	Duration of SEA/ Exam	**$2^{1}/_{2}$ hours**
Formative Assessment Marks	**40**	Summative Assessment Marks	**60**

Course Pre-requisite (s):

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

CO1. Importance of water and the mechanism of transport.
CO2. To understand biosynthesis and breakdown of biomolecules.
CO3. Role of plant hormones in plant development and about secondary metabolites.
CO4. Preliminary understanding of the basic functions and metabolism in a plant body.
CO5. To understand the importance of nutrients in plant metabolism and crop yield.

Contents	**56 Hrs**
UNIT 1	**14 hrs**
Plant water relations: Importance of Water as a solvent, Diffusion, osmosis, imbibition, osmotic potential, turgor pressure, wall pressure, water potential and its components. Mechanism of water absorption, Factors affecting water absorption. **Transpiration:** Types, Stomatal apparatus and mechanism of stomatal movement. Antitranspirants. **Mechanism of ascent of sap:** Vital and physical force theories. **Phloem Transport:** Transport of organic solutes. Path of transport, vein loading and unloading. Transcellular hypothesis and mass flow hypothesis. **Mineral nutrition:** A brief account on Micro and macro nutrients**.**	
UNIT 2	**14 hrs**
Photosynthesis: Photosynthetic pigments (Chl a, b, Xanthophylls and Carotene) Photosystem I and II, reaction center, antenna molecules; Electron transport and mechanism of ATP synthesis; C3, C4 and CAM pathways of carbon fixation; Photorespiration. **Respiration**: Glycolysis, TCA cycle; Oxidative phosphorylation and Anaerobic respiration **Nitrogen metabolism:** Biological nitrogen fixation; Nitrate and ammonia assimilation.	
UNIT 3	**14 hrs**
Definition and classification of plant growth regulators – Hormones, site of synthesis, and influence on plant growth and development of individual group of hormones - Auxins, Gibberellins, cytokinins, ABA and ethylene **Synthetic growth regulators** - Classification, their effect on plant growth and development. Practical utility in agriculture and horticulture**.** **Sensory Photobiology** - Biological clocks, photoperiodism, function & structure of phytochromes, phototropin and cryptochrome. Senescence - Aging and Cell Death (PCD and Autophagosis). Plant Movements – Tropisms	

UNIT 4	14 hrs
Carbohydrate metabolism – Cellulose and starch – structure and function. **Enzymes** - Classification, kinetics and mechanism of action. **Proteins** - Classification, structure - primary, secondary, tertiary and quaternary. Amino acids – A brief account. **Vitamins** - Classification, distribution and function. **Lipids** - Classification, structure and function of fatty acids. **Secondary plant products**: Distribution of terpenes, phenolics and nitrogen containing compounds and their role in plants	

Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs 1-15)

Course Outcomes (COs) / Program Outcomes (POs)	Program Outcomes (POs)														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Core competency															
Critical thinking															
Analytical reasoning															
Research skill															
Team work															

Formative Assessment for Theory paper DSC-BOT- C17-T

Assessment	Marks
Attendance	10 Marks
Test	10 Marks
Seminar	10 Marks
Assignment	10 Marks
Total	40 Marks

Pedagogy: Teaching, learning, Assignments, Practical and Seminar skills

B. Sc. BOTANY – VI Semester

PLANT PHYSIOLOGY AND PLANT BIOCHEMISTRY (Practical)

Course Title	**Plant Physiology and Biochemistry(Practical)**	Practical Credits	**2**
Course Code	**DSC-BOT- C16-P**	Contact Hours	**52 Hours**
Formative Assessment	**25 Marks**	Summative Assessment	**25 Marks**

Practical Content/Experiments

1. Conduct the experiment to demonstrate the phenomenon of exosmosis and endosmosis.
2. Determine the osmotic pressure of the cell sap by plasmolytic method.
3. Demonstrate root pressure / transpiration pull in plants.
4. Compare the rate of transpiration from the two surfaces of leaf by cobalt chloride paper method.
5. Demonstrate that oxygen is liberated in the process of photosynthesis.
6. Separation of photosynthetic pigments by paper chromatography and measure their Rf values.
7. Separate the chloroplast pignments by Arnon method.
8. Isolate and identify the amino acids from a mixture using paper chromatography.
9. Study of Phototropism.
10. Qualitative tests for Starch, Protein, Reducing Sugars and Lipids.
11. Estimation of TAN (Titratable acid Number) from *Bryophllum l*eaves/*Aloe vera.*
12. Visit to Research Institute/Scientific laboratory.

Formative Assessment for Practical	
Assessment	**Marks**
Attendance	05 Marks
Test	10 Marks
Project report and Industrial visit (5 + 5)	10 Marks
Total	**25 Marks**

GENERAL PATTERN OF THEORY QUESTION PAPER

(60 marks for semester end Examination with $2^{1}/2$ Hours duration)

Part-A

1. Question number 1-06 carries 2 marks each. Answer any 05 questions: 10 marks

Part-B

2. Question number 07- 11 carries 05 marks each. Answer any 04 questions: 20 marks

Part-C

3. Question number 12-15 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

PLANT PHYSIOLOGY AND PLANT BIOCHEMISTRY

Time: 04 Hours **Max. Marks: 25**

1. Conduct Major Experiment **A.**		06 marks
2. Comment on minor Experiments **B & C.**	(3 + 3)	06 marks
3. Perform biochemical test of sample **D.**		04 marks
4. Viva-voce		04 marks
5. Practical Record		05 marks

General Instructions:

Q1. Osmotic potential/paper chromatographic separation of pigments **(A)**
Q2. $CoCl_2$ /O_2 evolution/Root pressure/transpiration pull experiments **(B & C)**
Q3. Qualitative tests for Starch, Protein, Reducing Sugars and Lipids **(D)**
Q4. Viva-voce
Q5. Practical record

Pedagogy: Teaching and learning, Seminar, Assignments, etc

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Internship for Graduate Programme **(As Per UGC & AICTE)**

Course title	Internship Discipline specific
No of contact hours	90
No credits	2
Method of evaluation	Presentations/Report submission/Activity etc.,

- Internship shall be Discipline Specific of 90 hours (2 credits) with a duration 4-6 weeks.
- Internship may be full-time/part-time (full-time during semester holidays and part-time in the academic session)
- Internship mentor/supervisor shall avail work allotment during 6th semester for a maximum of 20 hours.
- The student should submit the final internship report (90 hours of Internship) to the mentor for completion of the internship.
- The detailed guidelines and formats shall be formulated by the universities separately as prescribed in accordance to UGC and AICTE guidelines.