## Government of Karnataka





## Curriculum Framework for Undergraduate Programme in Colleges and Universities of Karnataka State.

## 5th Semester Model Syllabus for B.Sc. iBOTANY

Submitted to:

Vice Chairman Karnataka State Higher Education Council 30, Prasanna Kumar Block, Bengaluru City University Campus, Bengaluru, Karnataka\_ 560009

## **Composition of Subject Expert Committee Members**

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3	Dr. G. R. Janardhana, Professor, University of Mysore, Mysuru
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Government of Karnataka

# Model Curriculum of B.Sc. in BOTANY 5<sup>th</sup>Semester

Karnataka State Higher Education Council

Karnataka State Higher Education Council Listing of Courses from V and VI Semesters for the Undergraduate Program in BOTANY

Som	Course			Credita	Instructional		Duration	Exam/ Evaluation		
Sem.	Cotogowy	Course	Course Title	Acciented	hours	per week	of Exam	Pattern (Marks)		
INO.	Category	Code		Assigned	Theory	Practical	(Hrs.)	IA	Exam	Total
			BOTANY AS SINGLE MAJOR	IN TH	IRD					
			YEAR							
V	DSC	BOT C9-T	Plant Morphology and Taxonomy	4	4		2	40	60	100
		BOT C10-P	Plant Morphology and Taxonomy	2		4	3	25	25	50
		BOT C11-T	Genetics and Plant Breeding	3	3		2	40	60	100
		BOT C12-P	Genetics and Plant Breeding	2		4	3	25	25	50
		BOT C13-T	Cell Biology	3	3		2	40	60	100
		BOT C14-P	Cell Biology	2		4	3	25	25	50
	DSE	BOT E1-T	A. Algal and Fungal Biotechnology							
		(Anyone to	B. Bio fertilisers	3	3		2	40	60	100
		be chosen)	C. Biofuels							
	Vocational	BOT V1-T	A. Landscaping and gardening							
		(Anyone to	B. Mushroom Cultivation Technology	3	3		2	40	60	100
		be chosen)	C. Community Forestry							
VI	DSC	BOT C15-T	Plant Physiology and Biochemistry	4	4		2	40	60	100
		BOT C16-P	Plant Physiology and Biochemistry	2		4	3	25	25	50
		BOT C17-T	Bioinformatics and computational biology	3	3		2	40	60	100
		BOT C18-P	Bioinformatics and computational biology	2		4	3	25	25	50
		BOT C19-T	Plant Biotechnology	3	3		2	40	60	100
		BOT C20-P	Plant Biotechnology	2		4	3	25	25	50
	DSE	BOT E2-T	A. Herbal Drug Technology	3	3		2	40	60	100
		(Anyone to	B. Techniques in Plant Biology							
		be chosen)	C. Floriculture							

Vocational	BOT V2-T	A. Plant Quarantine	3	3	2	40	60	100
	(Anyone to be chosen)	<ul><li>B. Plant Diversity and Human Welfare</li><li>C.</li></ul>						

			<b>BOTANY AND ANOTHER SUBJECT AS DOUB</b>	LE MAJ(	DRS IN T	HIRD YE	AR			
	DSC	BOT C9-T	Plant Morphology and Taxonomy	4	4		2	40	60	
		BOT C10-P	Plant Morphology and Taxonomy	2		4	3	25	25	
		BOT C11-T	Genetics and Plant Breeding	<mark>4</mark>	4		2	40	60	
		BOT C12-P	Genetics and Plant Breeding	2		4	3	25	25	
VI	DSC	BOT C13-T	Cell Biology	<mark>4</mark>	4		2	40	60	
		BOT C14-P	Cell Biology	2		4	3	25	25	
		BOT C15-T	Plant Physiology and Biochemistry	4	4		2	40	60	
		BOT C16-P	Plant Physiology and Biochemistry	2		4	3	25	25	

#### BOT C16-P | Plant Physiology and Biochemistry 2 3

Open Electives for non-BOTANY Students are also to designed and contents drafted for the first three semesters with multiple options.

Prof. B. ThimmeGowda, KSHEC.

100

50

100

50

#### Note:

V

- 1. If any Elective or Vocational course involves theory-cum-practical (2+1 credit), then IA to Exam Marks will be in the ratio of 50:50. The practical part is to be evaluated as part of IA. Semester end examination is only in theory component and questions from practical part, if any.
- 2. C11, C12, C13 and C14- paper model syllabus given below is designed for single major therefore C11& C13 consists of 3 credits and C12, C14 contains the related practical syllabus respectively. University BoS who choose double major will have to include 4 credit syllabus (one extra unit) for C11 and C13 papers along with the practical experiments in their respective practical papers (C12, C14)



## **BOTANY Curriculum**

## Plant Morphology and Taxonomy (Theory)

Program Name	B.Sc. in BO	TANY		Semester	V
Course Title	Plant Morphology and Taxonomy (Theory)				
Course Code:	DSC – BOT	с-С9 - Т		No. of Credits	04
Contact hours	60 Hours	) Hours		Duration of SEA/Exam	2 hours
Formative Assess	nent Marks	40	Sum	mative 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	60 Hrs
Unit 1:	15 hrs
<ul> <li>Morphology of Root, Stem and Leaf. Their modifications for various functions. Inflorescence – types. Structure and variations of flower. Fruits-types. Floral diagram and floral formula.</li> <li>Introduction to Taxonomy: History, objectives, scope and relevance of Taxonomy</li> <li>Systems of classification: Artificial, Natural and Phylogenetic; brief account of Linnaeus', Bentham&amp; Hooker's, system and APG IV System (2016)Merits and demerits of classification.</li> <li>Herbaria and Botanical gardens: Important herbaria and botanical gardens of the world and India. Technique of Herbarium Preparation and roles botanical gardens.</li> <li>Virtual herbarium; E-flora; Documentation.</li> </ul>	
Unit 2:	15 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 (Any 15 from the listed): Annonaceae, Brassicaceae, Fabaceae (with sub Families), Myrtaceae, Cucurbitaceae, Apiaceae, Rubiaceae, Asteraceae, Apocynaceae, Solanaceae, Lamiaceae, Amaranthaceae, Euphorbiaceae, Orchidaceae, Liliaceae, Arecaceae and Poaceae. Plant Taxonomic Evidences: from palynology embryology, cytology, phytochemistryand Field inventory.	
Unit 3:	15 hrs
<b>Taxonomic Hierarchy</b> : Concept of taxa (family, genus, species); Categories and taxonomic hierarchy; Species concepts (biological, morphological, evolutionary). Modes of speciation. Problems with species concepts. Rank less system of phylogenetic systematics <b>Botanical Nomenclature:</b> 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:	15 hrs
<ul> <li>Biometrics, Numerical Taxonomy; Phenetics and Cladistics: Characters; Variations; OTUs, character weighting and coding; Cluster analysis; Phenograms, cladograms (definitions and differences).</li> <li>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).</li> <li>Origin and evolution of angiosperms; Co-evolution of angiosperms and animals; Methods of illustrating evolutionary relationship (phylogenetic tree, cladogram).</li> <li>Molecular taxonomy: Respect to DNA sequences of chloroplast genes (<i>atp</i>B, rbcL, ITS, trnLetc) and one nuclear gene (nuclear ribosomal 18s DNA).</li> </ul>	

Pedagogy: Teaching and learning, Seminar, Assignments, etc

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

Program Name	B.Sc. i	n BOTANY		Semester	V
Course Title	Plant N	Aorphology and Taxonomy (l	Practical)	Practical Credits	02
Course Code	DSC –	ВОТ - С10 - Р		Contact Hours	4 Hours per week
Formative Assessment 25 Marks Summ		ative Assessment	25 Marks		

#### **Practical Content**

1. 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.

2. Study of families mentioned in theory with at least two examples for 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. 26 hrs

2. Construction of plant phylogenetic trees using various loci (*atp*B, rbcL, ITS, trnLetc) with various phylogenetic methods (Neibour Joining, Maximum Likelihood etc). 06 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, Brinjal, Tomato, Chilly, Tamarind, Bitter gourd, *Luffa*, Asfoetida, Cumin, Coriander, Coffee, Rubber, Tapioca, Ricinus, Coir, Arecanut, Rice, Wheat, Ragi, Sugarcane *AnnonamuricataCatharanthus roses*, *Rauvolfiaserpentaina*, , *Vitexnigundo* and *Leucasaspera* 16 hrs

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

5. **Submission:** Record book, Tour report and Herbarium (Preparation of 10 properly identified herbarium specimens(Only weed plants); 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.

Formative Assessment for Practical					
Assessment Occasion/ type	Marks				
Attendance	05				
Test	05				
Field visit (3 to 5 days)	05				
Submission (Record book, Tour report and Herbarium)	10				

Total

Formative Assessment as per guidelines are compulsory

## GENERAL PATTERN OF THEORY QUESTION PAPER

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

Pa	art-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 n necessary)	nay have sub-questions	for 7+3 or 6+4 or 5+5 if

Total: 60 Marks

**Total 25 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 technical description.	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

#### **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

Refe	erences
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 - McGraw Hill, New York.
6	Hall, B.G. (2011). <i>Phylogenetic Trees Made Easy: A How-To Manual</i> . 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 <i>Plant Taxonomy</i> . Cambridge University Press, Cambridge
10	Judd, W.S., Campbell, C.S., Kellogg, E.A., Stevens, P.F., Donogue, M.J., 2002. <i>Plant Systematics: A Phylogenetic approach</i> , 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. <i>Taxonomy and Plant Conservation</i> . 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.

## **Genetics and Plant Breeding (Theory)**

Program Name	B.Sc. in BO	ΓΑΝΥ	Semester	V
Course Title	e Genetics and Plant Breeding (The		ory)	
Course Code:	DSC – BOT-C11 - T		No. of Credits	03
Contact hours	act hours 45 Hours		Duration of SEA/Exam	2hours
Formative Assessment Marks <b>40</b>		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.Interpret heresults of mating and pollinations.

CO4.ClassifyPlantpollination methods

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

Contents	60 hrs
Unit 1:	15hrs
<ul> <li>Mendelian genetics and its extension Mendelism: History; Principles of inheritance;</li> <li>Chromosome theory of inheritance; Autosomes and sex chromosomes;</li> <li>Probability and pedigree analysis; Incomplete dominance and</li> <li>codominance; Multiple alleles, Lethal alleles, Epistasis, Pleiotropy, Recessive and</li> <li>Dominant traits, Penetrance and Expressivity, Numericals; Polygenic inheritance.</li> <li>Extrachromosomal Inheritance Chloroplast mutation: Variegation in Four o'clock plant;</li> <li>Mitochondrial mutations in yeast.</li> </ul>	
Unit 2:	15hrs
<ul> <li>Linkage, crossing over and chromosome mapping.</li> <li>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. Variation in chromosome number and structure: Gene mutations Types of mutations; Molecular basis of Mutations; Mutagens – physical and chemical</li> <li>(Base analogs, deaminating, alkylating and intercalating agents); Detection of mutations: CIB 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.</li> </ul>	
Unit 3:	15hrs

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.	
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	

Pedagogy: Teaching and learning, Seminar, Assignments, etc

Formative Assessment for Theory			
Assessment Occasion/type	Marks		
Attendance	10		
Test (Objective type)	10		
Assignments	10		
Seminar	10		
Fotal 40 Marks			
Formative Assessment as per guidelines are compulsory			

Program Name	B.Sc. in BOTANY	Semester	V
Course Title	Genetics and Plant Breeding (Practical)	Practical Credits	02
Course Code	DSC – BOT – C12 - P	Contact Hours	4 Hours per week
Formative Assessment	25 Marks	Summative Assessment	25 Marks
Practical Content			

#### **Practical: Plant breeding:**

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

#### **Practical: Genetics**

- 1. Mendel's laws through seed ratios. Laboratory exercises in probability and chi-square.
- 2. Chromosome mapping using point test cross data.

Pedigree analysis for dominant and recessive autosomal and sex-linked traits.

- 3. Incomplete dominance and gene interaction through seed ratios (9:7, 9:6:1, 13:3, 15:1, 12:3:1, 9:3:4).
- 4. Study of aneuploidy: Down's, Klinefelter's and Turner's syndromes.
- 5. Photographs/Permanent Slides showing Translocation Ring, Laggards and Inversion Bridge.

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

Formative Assessment for Practical		
AssessmentOccasion/type	Marks	
Attendance	05	
Test	05	
Field visit	05	
Submission	10	
Total	25Marks	
Formative Assessment as per guidelines are compulsorv		

## **GENERAL PATTERN OF THEORY QUESTION PAPER**

#### (60 marks for semester end Examination with 2 hrs duration) Part-A

1. Question number 1-06 carries 2 marks each. Answer any 05 questions: Part-B	10 marks
3.Question number 07-11 carries 05 Marks each. Answer any 04 questions: Part-C	20 marks
<b>3.</b> 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

1. Perform the emasculation / pollen viability / fertility of the given sample A 5 Marks

2. Calculate the recombinant frequency and state the order of genefrom the given data **B** 

4. Identification of Specimen/slides/ Photographs C, D and E

6. Submission (Journal / Record)

#### **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

Refe	rences
1	Acquaah, G. (2007). Principles of Plant Genetics & Breeding. New Jearsey, 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.

## **Cell Biology (Theory)**

Program Name	ame <b>B.Sc. in BOTANY</b>		Semester	V
Course Title Cell Biology (Theory)				
Course Code: DSC-BOT - C13-T		No. of Credits	03	
Contact hours 45 Hours		Duration of SEA/Exam	2hours	
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 of Cell metabolism, chemical composition, physiochemical and functional organization of organelle

CO2. Contemporary approaches in modern cell and molecular biology.

CO3.To study the organization of cell, cell organelles and biomolecules (i.e protein, carbohydrate, lipid and nucleic acid)

CO4.To gain knowledge on the activities in which the diverse macro molecules and microscopic structures inhabiting the cellular world of life are engaged.

CO5.To understand the various metabolic processes such as respiration, photosynthesis etc. which are important for life.

Contents	45Hrs
Unit 1:	15hrs
Cell wall, distribution, chemical composition, functions and variations in prokaryotic and eukaryotic cells (primary and secondary wall), Glycocalyx, Cell-cell interactions/ Junctions, pit connections. Phases of eukaryotic cell cycle, mitosis and meiosis; Regulation of cell cycle- checkpoints, role of protein kinases. Programmed Cell Death; Biology and elementary knowledge of development and causes of cancer.	
Unit 2:	15hrs
Structure and functions, active and passive transport, proton pumps associated (Na-K, Cacalmodulin etc. and their distribution), phagocytosis, pinocytosis, exocytosis. Structural organization, function, marker enzymes of the above organelles, biogenesis of	
mitochondria and chloroplasts, brief account of transport in mitochondria and chloroplasts (Tim/Tom; Tic/Toc) and semiautonomous nature of mitochondria and chloroplast	
Unit 3:	15hrs
Nuclear envelope, structure of nuclear pore complex, nuclear lamina, transport across nuclear membrane, Nucleolus, rRNA processing.	
Endoplasmic Reticulum – Structure, targeting and insertion of proteins in the ER, protein folding, processing; Smooth ER and lipid synthesis, export of proteins and lipids; Golgi Apparatus – organization, protein glycosylation, protein sorting and export from Golgi Apparatus; Lysosomes	

#### Pedagogy: Teaching and learning, Seminar, Assignments, etc

Formative Assessment for Theory		
Assessment Occasion/type	Marks	
Attendance	10	
Test(Objectivetype)	10	
Assignments	10	
Seminar	10	
Total	40 Marks	
Formative Assessment as per guideling	es are compulsory	

Course Title	Cell Bio	ology (Practical)			Practical Credits	02
Course Code	DSC-B	OT - C14-P			Contact Hours	4 Hours per week
Formative Assess	sment	25Marks		Summative As	ssessment	25 Marks
		Practical C	Content			

- Study of plant cell structure with the help of epidermal peel mount of Onion/ Rhoeo/ Crinum. 1.
- 2. Study of cell and its organelles with the help of electron micrographs.
- 3. Measurement of length and breadth of plant cell using micrometry.

4. Study different stages of mitosis and meiosis (Onion/ Rhoeo/ Crinum) 5. Study of Karyotype using camera-lucida / chart.

6. Isolation of cell organelle – Chloroplast.

## **GENERAL PATTERN OF THEORY QUESTION PAPER**

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

<b>Part-A</b> 1. Question number 1-06 carries 2 marks each. Answer any 05 questions:	10 marks
<b>Part-B</b> 4.Question number 07- 11 carries 05 Marks each. Answer any 04 questions:	20 marks
<b>Part-C</b> <b>3.</b> 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 BIOLOGY**

1. Preparation of squash/ smear of material A, identify, Sketch and label the any two stages with reasons 06 marks

- 2. Find out cell length and breadth of the given material using micrometry 05marks
- 3. Identify the slides C & D
- 4. Viva-voce
- 5. Submission (Journal/ Record + 5 slides)

#### **General instructions:**

- Q1. Give specimen from Onion/ Rhoeo/ Crinum plant (A)
- Q2. Give specimen from Onion/ Rhoeo leaf (B)
- Q3. Give slide from mitosis (C) meiosis (D)
- O4. Viva-voce
- Q5. Submission (Journal/ Record + 5 slides)

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

Refe	rences
1	Cooper, G.M., Hausman, R.E. (2009). The Cell: A Molecular Approach, 5th edition. Washington, D.C.:
	ASM Press & Sunderland, Sinauer Associates, MA
2	Karp, G. (2010). Cell Biology, 6th edition. New Jersey, U.S.A.: John Wiley & Sons.

Time =03 hrs

Marks =25

04 marks

05 marks

05 marks Total 25 marks

3	De Robertis, E. D. P. and De Robertis R. E. 2009. Cell and Molecular Biology, 8th edition. Lippincott
	Williams and Wilkins, Philadelphia.
4	Becker W. M., Kleinsmith L.J. and Bertni G. P. 2009. The World of the Cell. 7th edition. Pearson
	Benjamin Cummings Publishing, San fransisco.
5	Reven, F.H., Evert, R.F., Eichhorn, S.E. (1992). Biology of Plants. New York, NY: W.H.Freeman and
	Company
6	Alberts, B., Bray, D., Hopkin, K., Johnson, A. D., Lewis, J., Raff, M., Roberts, K., & Walter, P. (2013).
	Essential cell biology (4th ed.). Garland Publishing.
7	Raven, F.H., Evert, R. F., Eichhorn, S.E. (1992). Biology of Plants. New York, NY: W.H. Freeman and
	Co.
8	Verma, P. S. (2004). Cell Biology, Genetics, Molecular Biology: Evoloution and Ecology. India: S. Chand
	Limited.

# ELECTIVE PAPERS (Anyone to be chosen)

- A. Algal and Fungal Biotechnology (Theory)
- **B. Bio-fertilizers (Theory)**
- C. Bio-fuels (Theory)

## A.Algal and Fungal Biotechnology (Theory)

Program Name	B.Sc. in BOT	ANY	Semester	v
Course Title	Algal and Fu	ngal Biotechnology (The	ory)	
Course Code:	BOT E1-A		No. of Credits	03
Contact hours	45 Hours		Duration of SEA/Exam	2hours
Formative Asses	sment 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. To provide knowledge on the structure and reproduction of certain selected algal and fungi CO2. To introduce students to basics of algal biotechnology and economic importance of both groups. CO3.To understand the role of fungi in our society and how fungi can be used for more applied aspects CO4.To gain knowledge on the industrial applications of fungi Contents 45Hrs Unit 1: 15hrs Introduction to algal biotechnology: Resource potential of algae; commercial utility of algae. Algae as a source of food and feed; Algae as a source of pigments, fine chemicals, fuel and bio-fertilizers. Role of algae in the environment, agriculture, biotechnology and industry. Algal biotechnology: single cell proteins (SCP): Spirulina as single cell protein-production and harvesting of algal biomass - factors affecting biomass production. Unit 2: 15hrs Cyanobacterial inoculants (BGA): Isolation, preparation of starter culture, mass cultivation, field applications and crop response. Economic importance of algae: commercial products of algae: Agar Agar, Alginates, Carrageenin, diatomite, mucilage, minerals and elements - Algae in medicine. Unit 3: 15hrs Role of fungi in biotechnology, Application of fungi in food industry (Flavour & texture, Fermentation, Baking, Organic acids, Enzymes, Mycoproteins); Secondary metabolites (Pharmaceutical preparations); Agriculture (Mycorrhiza); Mycotoxins; Biological control

Pedagogy: Teaching and learning, Seminar, Assignments, etc

medicines (Antibiotics).

Formative Assessment for The	ory
Assessment Occasion/type	Marks

(Mycofungicides, Mycoherbicides, Mycoinsecticides, Myconematicides); Fungi as source of

Seminar	10
Assignments	10
Test (Objective type)	10
Attendance	10

## **GENERAL PATTERN OF THEORY QUESTION PAPER**

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

Part-A	
1. Question number 1-06 carries 2 marks each. Answer any 05 questions:	10 marks
<b>Part-B</b> 5.Question number 07- 11 carries 05 Marks each. Answer any 04 questions:	20 marks
<b>Part-C</b> <b>3.</b> 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.

Refe	rences
1	Webster, J. and Weber, R. (2007). Introduction to Fungi, Cambridge University Press, Cambridge. 3rd edition.
2	Sethi, I.K. and Walia, S.K. (2011). Text book of Fungi and Their Allies, Macmillan Publishers India Ltd.
3	Kumar, H.D. (1999). Introductory Phycology, 2nd edition. New Delhi, Delhi: Affiliated East-West Press.
4	Raven, F.H., Evert, R.F., Eichhorn, S.E. (1992). Biology of Plants. New York, NY: W.H. Freeman and Company
5	Sahoo, D. (2000). Farming the ocean: seaweeds cultivation and utilization. New Delhi, Delhi: Aravali International.
6	Lee, R.E. (2008). Phycology, Cambridge University Press, Cambridge. 4th edition
7	Barsanti, Laura and Paolo Gualtieri 2005 Algae-Anatomy, Biochemistry and Biotechnology. Taylor & Francis, London, New York.

<b>D.DIU-IEI UIIZEI S</b> $(1 \text{ HeOF } \mathbf{y})$	<b>B.Bio-fertilizers</b> (Th	eory)
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ProgramName	B.Sc. in BOT	ANY	Semester	V
Course Title Bio-fertilizers (Theory)		s (Theory)		
Course Code: BOT E1-B		No. of Credits	03	
Contact hours 45 Hours			Duration of SEA/Exam	2hours
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: Explain isolation and role of various soil bacteria in bio-fertilizer production. CO2: Describe production steps and specific requirements for each bio-fertilizers CO3: Restore the soil fertility by performing the sustainable agriculture practices via organic farmin. Apply the knowledge gained to generate opportunities of self-employability.	g CO4:
Contents	45Hrs
Unit 1:	15hrs
General account about the microbes used as biofertilizer – Rhizobium – isolation, identification, mass multiplication, and carrier based inoculants, Actinorrhizal symbiosis. Azospirillum: isolation and mass multiplication – carrier based inoculant, associative effect of different microorganisms. Azotobacter: classification, characteristics – crop response to Azotobacter inoculum, maintenance and mass multiplication. Cyanobacteria (blue green algae), Azolla and Anabaena azollae association, nitrogen fixation, factors affecting growth, blue green algae and Azolla in rice cultivation.	
Unit 2:	15hrs
Mycorrhizal association, types of mycorrhizal association, taxonomy, occurrence and distribution, phosphorus nutrition, growth and yield – colonization of VAM – isolation and inoculum production of VAM, and its influence on growth and yield of crop plants.	
Unit 3:	15hrs
Organic farming – Green manuring and organic fertilizers, Recycling of biodegradable municipal, agricultural and Industrial wastes – biocompost making methods, types and method of vermicomposting – field Application.	

Pedagogy: Teaching and learning, Seminar, Assignments, etc

Formative Assessment for The ory		
Assessment Occasion/type	Marks	
Attendance	10	

Formative Assessment as per guidelines are compulsory		
Total	40Marks	
Seminar	10	
Assignments	10	
Test (Objective type)	10	

Formative Assessment as per guidelines are compulsory

## **GENERAL PATTERN OF THEORY QUESTION PAPER**

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

Part-A	
1. Question number 1-06 carries 2 marks each. Answer any 05 questions:	10 marks
Part-B	
6.Question number 07- 11 carries 05 Marks each. Answer any 04 questions:	20 marks
<b>Part-C</b> <b>3.</b> 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.

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

## C.Bio-fuels (Theory)

Program Name	<b>B.Sc.in BOT</b>	ANY	Semester	V
Course Title	Bio fuels (The	eory)		
Course Code:	BOT E1-C		No. of Credits	03
Contact hours	45Hours		Duration of SEA/Exam	2hours
Formative Assess	sment Marks	40	Summative Assessment Marks	60

Course Pre-requisite (s):		
<b>Course Outcomes (COs)</b> : After the successful completion of the course, the student will be able to:	CO1	
The student will be aware from a technical point of view of energy plants where biomasses and organic		
wastes are used.	ne	
CO2. The student will be capable to apply the acquired knowledge to design biomass energy plants a	nd to	
evaluate their performances.		
CO3. The student will became capable to judge the different options available given the nature of the		
feedstock available (kind of biomass, kind of organic waste) and the technological opportunities to va	alorize it	
as bioenergy		
CO4. The student will be capable to efficiently communicate concerning bio-energy options, proce	sses and	
plants.		
CO5. The student will be taught that significant bioenergy process advancements are in progress, and	l that	
he/she should keep him/herself updated on the last technological outcomes that face the bio-energy n	narket.	
Contents	45Hrs	
Unit 1:	15hrs	
Introduction, definition, scope and Importance of Bio-fuel. Institutions related to biofuels in India		
and worldwide. Public awareness of biofuel.		
Biofuels scenario -in India and worldwide. History of Biofuel; Advantages and disadvantages of		
biofuels. Generation of biofuels: first, second, third and fourth generation of biofuels and present		
status.		
Unit 2:	15hrs	
Biofuel feed stocks: Agricultural waste, farm waste, forestry waste, organic wastes from the		
residential, institutional and industrial waste and its importance. (Biomass-plant, animal and microbial based waste). Algal biofuel.		
Biodiesel species: Pongamiapinnata, Simaroubagluca, Jatrophacurcas, Azardirachtaindia,		
Madhucaindica and Callophylluminnophyllumetc.; oil content analysis and characterization.		
Unit 3:	15hrs	
Introduction to biodiesel, bioethanol, biogas and biohydrogen; production technology of biofuels, quality analysis of biodiesel, bioethanol and biogas and its comparison with national and intermetional standards.		
Richard Standards. Biofuel sustainability: Biofuel Policy in India and around the worldwide: Biofuel production		
statistics: production of Piodiccal biosthanal bioges in Countrywide		
statistics: production of Biodiesei, dioetnanoi, diogas in Countrywide		

Pedagogy: Teachingandlearning, Seminar, Assignments, etc

Formative Assessment for Theory	
Assessment Occasion/type	Marks
Attendance	10
Test (Objective type)	10
Assignments	10
Seminar	10
Total	40Marks
Formative Assessment as per guideli	nes are compulsory

## **GENERAL PATTERN OF THEORY QUESTION PAPER**

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

10 marks
20 marks
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.

Refe	erences
1	The Biodiesel Handbook (2005). JurgenKrahl, Jon Harlan Van Gerpen. AOCS Press.
2	Bioenergy and Biofuels (2017).OzcanKonur. CRC Press, Taylor & Franci's group.
3	https://mnre.gov.in/biofuels
4	Biomass for renewable energy, fuels, and chemicals. D.L. Klass, Academic Press,
	http://www.sciencedirect.com/science/book/9780124109506
5	Sistemi a biomasse: progettazione e valutazioneeconomica. E. Bocci, A. Caffarelli, M. Villarini, A.
	D'Amato, MaggioliEditore, http://www.maggiolieditore.it/9788838759697-sistemi-a-
	biomasseprogettazione-e-valutazioneeconomica.html



## **Model Curriculum of B.Sc. in BOTANY**

Semester

## Karnataka State Higher Education Council

Curriculum Framework for Undergraduate Programme in Colleges and Universities of Karnataka State.

## 6th Semester Model Syllabus for B.Sc. iBOTANY

Submittedto:

Vice Chairman Karnataka State Higher Education Council 30, Prasanna Kumar Block, Bengaluru City University Campus, Bengaluru, Karnataka\_ 560009

## **Composition of Subject Expert Committee Members**

SN	Name & Organization
1	Dr. G. R. Naik, Vice Chancellor, Garden City University, Bengaluru
2	Dr.Rajasab, M S Ramaiah University of Applied Science, Bangalore
3	Dr. G. R. Janardhana , Professor, University of Mysore, Mysuru
4	Dr.Kotresh K, Professor, Karnatak University, Dharwad
5	Dr. L. Rajanna, Professor, Bangalore University, Bengaluru
6	Dr.Siddaraju M L, Professor, Mangalore University, Konaje
7	Dr. Krishnamurthy YL, Professor, Kuvempu University, Shivamogga
8	Dr.Govindappa M, Professor, Davanagere University, Davanagere
9	Dr.Sharanappa P, Hassan University Hassan.
10	Dr. H. Ramakrishnaiah, Assoc. Professor, Maharani Cluster University, Bengaluru
11	Shri M. N. Mallikarjunaiah, Assoc. Professor, Mandya University, Mandya.
12	Dr. Abdul Khayum, Assoc. Professor, Govt. Womens College, Kolar – 563 101
13	Dr.Mamatha, Assoc. Professor, GFGC, Vijayanagar, Bengaluru
14	Dr.JayakaraBhandary, Professor, GFGC, Mangalore.
15	Dr.Latha Devi Karekal, Sharanabasaveshwara college of Science, Kalaburgi.
16.	Smt. Akshatha Chandra G. R., Special Officer, KSHEC- Member Convenor



## PLANT PHYSIOLOGY AND PLANT BIOCHEMISTRY (THEORY)

Program Name	<b>BSc/ BOTANY</b>	Semester	VI
Course Title	Plant Physiology and Plant Biochemistry (Theory)		
Course Code:	BOT C15-T	No. of Credits	04
Contact hours	60 Hours	Duration of Exam	2hours
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	
UNIT 1	15 Hrs
<ul> <li>Plant water relations: Importance of Water as a solvent, Diffusion, osmosis, imbibition, osmotic pressure, osmotic potential, turgor pressure, wall pressure, water potential and its components. Mechanism of water absorption, Factors affecting water absorption.</li> <li>Transpiration. Types and process. Mechanism of guard cell movement. K+ ion mechanism.</li> <li>Antitranspirants.</li> <li>Mechanism of ascent of sap: Vital and physical force theories.</li> <li>Phleem Transport of organic solutes path of transport vein loading and</li> </ul>	
unloading. Transport: Transport of organic solutes. path of transport, vein loading and unloading. Transcellular hypothesis, mass flow hypothesis. Mineral nutrition : A brief account on Micro and macro nutrients .	
UNIT 2	15 Hrs
<ul> <li>Photosynthesis:</li> <li>Photosynthetic Pigments (Chl a, b, xanthophylls, 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.</li> <li>Respiration: Glycolysis, anaerobic respiration, TCA cycle; Oxidative phosphorylation, Glyoxylate, Oxidative Pentose Phosphate Pathway.</li> <li>Nitrogen metabolism: Biological nitrogen fixation; Nitrate and ammonia assimilation.</li> </ul>	
UNIT 3	15 Hrs

Growth Regulators : Definition and classification of plant growth regulators-	
Hormones. Site of synthesis, biosynthesis pathway and metabolism and influence on	
plant growth development of individual group of hormone- Auxins, Gibberlins,	
cytokinins, ABA, 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&cryptochromes.	
Senescence, Aging & Cell Death (PCD and Autophagosis).	
Plant Movements	
UNIT 4	15
UNIT 4	15 Hrs
UNIT 4 Carbohydrate metabolism	15 Hrs
UNIT 4 Carbohydrate metabolism Enzymes - classification, kinetics and mechanism of action.	15 Hrs
UNIT 4 Carbohydrate metabolism Enzymes - classification, kinetics and mechanism of action. Proteins and amino acids: classification, structure - primary, secondary, tertiary and	15 Hrs
UNIT 4 Carbohydrate metabolism Enzymes - classification, kinetics and mechanism of action. Proteins and amino acids: classification, structure - primary, secondary, tertiary and quaternary	15 Hrs
UNIT 4 Carbohydrate metabolism Enzymes - classification, kinetics and mechanism of action. Proteins and amino acids: classification, structure - primary, secondary, tertiary and quaternary Vitamins - classification, distribution, structure, production, function.	15 Hrs
UNIT 4 Carbohydrate metabolism Enzymes - classification, kinetics and mechanism of action. Proteins and amino acids: classification, structure - primary, secondary, tertiary and quaternary Vitamins - classification, distribution, structure, production, function. Lipids: classification, structure, function and biosynthesis of fatty acids.	15 Hrs
UNIT 4 Carbohydrate metabolism Enzymes - classification, kinetics and mechanism of action. Proteins and amino acids: classification, structure - primary, secondary, tertiary and quaternary Vitamins - classification, distribution, structure, production, function. Lipids: classification, structure, function and biosynthesis of fatty acids. Secondary plant products: structure, biosynthesis and distribution of terpenes, phenolics	15 Hrs

Assessment	Marks
Attendance	10 Marks
Test	10 Marks
Seminar	10 Marks
Assignment	10 Marks
Total	40 Marks
Formative Assessment as per guidelines are compulsory	

## **Pedagogy:**

Course Title	Dent Division and Dischamistry (Drastical)		Practical	2	
Course Thie	Plant I	Physiology and Biochemistry (Practical)		Credits	
Course Code	BOT	С16-Р		Contact Hours	4 Hours
Formative Ass	essment	25 Marks	Summative A	Assessment	25 Marks
		Practical Con	ntent		
1. Experir	nent to d	emonstrate the phenomenon of	exosmosis and	d endosmosis.	
2. To dete	rmine the	e osmotic pressure of the cell sa	ap by plasmoly	tic method.	
3. To demonstrate root pressure / transpiration pull in plants.					
4. To compare the rate of transpiration from the two surfaces of leaf by cobalt chloride paper					
method.					
5. To demonstrate that oxygen is liberated in the process of photosynthesis.					
6. Separation of photosynthetic pigments by paper chromatography and measure their Rf					
values. 7 Estimation of total chlorophyll content by Arnon method.					
7. To isolate and identify the amino acids from a mixture using paper chromatography.					
8. To Study of Phototrophism.					
9. Quantities test for Starch, Protein, Reducing Sugars and Lipids.					
10. Estimation of TAN(Titratbale acid Number) from Bryophllum leaves/Aloe Vera			ì		

10. Estimation of TAN(Titratbale acid Number) from Bryophllum leaves/Aloe Vera ..

## **GENERAL PATTERN OF THEORY QUESTION PAPER**

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

#### Part-A

Marks =25

1. Question number 1-06 carries 2 marks each. Answer any 05 questions:	10 marks
Part-B	
11.Question number 07- 11 carries 05 Marks each. Answer any 04 questions:	20 marks
Part-C	
<b>3.</b> 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 =03 hrs

1. 2.	Conduct Major Experiment A Comment on minor Experiments B & C	06 marks 06 marks
3.	Micro Chemical test D	03 marks
4.	Viva-voce	05 marks
5.	Practical Record + Industrial visit report	05 marks

Pedagogy: Teaching and learning, Seminar, Assignments, etc

Formative Assessment for Practical		
Assessment	Marks	
Attendance	10 Marks	
Test	10 Marks	
Project report / Industrial visit	05 Marks	
Total	25 Marks	
Formative Assessment as per guidelines are compulsory		

#### REFERENCES

1. Fundamentals of Biochemistry 2nd Ed, John Wiley and Sons Inc. Wilson, K. and Walker, J. 1994 2 .JainV K, 2008. Fundamentals of Plant Physiology.S Chand andCo.

3. Kochhar P L, Krishnamoorthy H N. Plant Physiology. Atmaram and sons, Delhi.

4. Kumar and Purohit. Plant Physiology: Fundementals and Applications. Agrobotanical Publishers.

5. Malik CP, 2002. Plant Physiology. Kalyani publishers.

- 6. Mukherjii S, Ghosh AK, 2005. Plant Physiology. New Central Book Agency, Culcutta.
- 7. Noggle GR, Fritz GJ, Introductory Plant Physiology.Prentice Hall of India.
- 8. Pandey SN, Sinha BK, 2006. Plant physiology. Vikas Publishing House, NewDelhi.
- 9. Salisbury F B, Ross C W, 1992. Plant Physiology. CBS publishers and Distributers, NewDelhi.
- 10. Sinha A K, 2004. Modern Plant Physilogy. Narosa publishing House, NewDelhi.
- 11. Srivastava H S, 2004. Plant physiology and Biochemistry. Rasthogi publications.
- 12. Verma V, 2007. Text Book of Plant Physiology. Ane Books Pvt. Ltd.

## PLANT BIOTECHNOLOGY (THEORY)

Program Name	B.Sc. in BOTANY	Semester	VI
Course Title	Plant Biotechnology (T	heory)	
Course Code:	BOT C-19 T	No. of Credits	03
Contact hours	60 Hours	Duration of SEA/Exam	2hours
Formative Assessment Marks	40	Summative Assessment Marks	60

#### **Course Pre-requisite(s):**

**Course Outcomes (COs)**: After the successful l completion of the course, the student will be able to: CO1. Explain the basics of the physiological and molecular processes that occur during plant growth and development and during environmental adaptations

CO2. Understand how biotechnology has been used to develop knowledge of complex processes that occur in the plant

CO3. Use basic biotechnological techniques to explore molecular biology of plants

CO4. Understand the processes involved in the planning, conduct and execution of plant biotechnology experiments

CO5. Explain how biotechnology is used for plant improvement and discuss the ethical implications of that use

Contents	60Hrs
Unit 1:	15hrs
Historical perspective; Composition of media; Nutrient and hormone requirements (role of vitamins and hormones); Totipotency; Organogenesis; Embryogenesis (somatic and zygotic); Protoplast isolation, culture and fusion; Tissue culture applications (micropropagation, androgenesis, virus elimination, secondary metabolite production, haploids, triploids and cybrids; Cryopreservation; Germplasm Conservation).	
Unit 2:	15hrs
Restriction Endonucleases (History, Types I-IV, biological role and application); Restriction Mapping (Linear and Circular); Cloning Vectors: Prokaryotic (pUC 18) Ti plasmid, BAC);phagemid, Cosmid, Shuttle vector; Eukaryotic Vectors (YAC Gene Cloning Recombinant DNA),	
Unit 3:	15hrs

Bacterial Transformation and selection of recombinant clones, PCR	-mediated gene cloning) Gene	
Construct; construction of genomic and cDNA libraries, screening I	ONA libraries to obtain gene	
of interest by genetic selection; complementation, colony hybridizat	tion; Probes-oligonucleotide,	
heterologous, PCR.		
Unit 4:		15hrs
Methods of gene transfer- Agrobacterium-mediated, Direct gene	transfer by Electroporation,	
Microinjection, Micro projectile bombardment; Selection of transg	genics- selectable marker and	
reporter genes (Luciferase, GUS, GFP).		
Pest resistant (Bt-cotton); herbicide resistant plants (RoundUp Read	ly soybean); Transgenic crops	
with improved quality traits (FlavrSavr tomato, Golden rice); Improved horticultural varieties		
(Moondust carnations); Role of transgenics in bioremediation (Superbug); Industrial enzymes		
(Aspergillase, Protease, Lipase); Biosafety concerns.		
Formative Assessment for Theory		
Assessment Occasion/type Marks		
Attendence	10	

Assessment Occasion/type	Marks	
Attendance	10	
Test (Objective type)	10	
Assignments	10	
Seminar	10	
Total	40 Marks	
Formative Assessment as per guidelines are compulsory		

Course Title	Plant Biotechnology (Practical)	Practical Credits	02
Course Code	BOT C-20 P	Contact Hours	45Hours
Formative Assessment	25 Marks	Summative Assessment	25Marks
	Practical Content		
<ol> <li>(a) Preparation of MS medium.</li> <li>(b) Demonstration of in vitro sterilization and inoculation methods using leaf and nodal explants of Tobacco/Datura/Brassica etc.</li> <li>Study of anther, embryo and endosperm culture, micropropagation, somatic embryogenesis</li> <li>3. Preparation of Artificial/Synthetic seeds.</li> <li>Isolation of protoplasts.</li> <li>Study and description of binary vectors by using photographs.</li> <li>Study of methods of gene transfer through photographs: <i>Agrobacterium</i>-mediated, direct gene transfer by electroporation, microinjection, micro projectile bombardment.</li> <li>Study of steps of genetic engineering for production of Bt cotton, Golden rice, FlavrSavr tomato through photographs.</li> <li>Isolation of plasmid DNA.</li> <li>Isolation and spectrophotometric quantification of DNA.</li> <li>Separation of DNA using agarose gel electrophoresis and gel documentation.</li> </ol>			

## **GENERAL PATTERN OF THEORY QUESTION PAPER**

## (60 marks for semester end Examination with 2 hrs duration) Part-A

1. Question number 1-06 carries 2 marks each. Answer any 05 questions:	10 marks
Part-B	
13. Question number 07-11 carries 05 Marks each. Answer any 04 questions:	20 marks
Part-C	
<b>3.</b> 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)

## SCHEME OF PRACTICAL EXAMINATION PLANT BIOTECHNOLOGY

#### Time =03 hrs

Marks =25

1.Isolation of plant DNA/ spectrophotometric quantification of DNA (A) 05

2. Preparation of Artificial/Synthetic Seed/ Inoculation using leaf and nodal explants (B)

04 marks

marks

- 3. Comment on Bt cotton, Golden rice, FlavrSavr tomato, microinjection, micro projectile bombardment, Agarose /PAGE electrophoresis, Transilluminator, PCR (C&D) 06 marks
- 4. Viva-voce 05 marks
- 5. Practical Record + Lab. visit report

05 marks

25 Marks

Pedagogy: Teaching and learning, Seminar, Assignments, etc

Formative Assessment for Practical	
Assessment Occasion/type	Marks
Attendance	05
Test	05
Lab. visit	05
Submission	10
Total	25 Marks
Formative Assessment as per guidelines are compulsory	

References	
1	Bhojwani, S.S. and Razdan, M.K., (1996). Plant Tissue Culture: Theory and Practice. Elsevier Science
	Amsterdam. The Netherlands.
2	Glick, B.R., Pasternak, J.J. (2003). Molecular Biotechnology- Principles and Applications of
	recombinant DNA. ASM Press, Washington.
3	Bhojwani, S.S. and Bhatnagar, S.P. (2011). The Embryology of Angiosperms. Vikas Publication House
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4	Snustad, D.P. and Simmons, M.J. (2010). Principles of Genetics. John Wiley and Sons, U.K. 5th edition
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