TUMKUR UNIVERSITY

DEPARTMENT OF BOTANY

SYLLABUS FOR
B. Sc. BOTANY (UG)
V & VI SEMESTER

Under Graduate (UG) Programme
Framed according to the
National Education Policy (NEP 2020)

To be implemented from the academic year
2023-24

BOTANY Curriculum
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	**60 Hours**	Duration of SEA/Exam	**2 hours**
Formative Assessment Marks	**40**	Summative Assessment Marks	**60**

	Course Pre-requisite(s):
	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**
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. **Introduction to Taxonomy**: History, objectives, scope and relevance of Taxonomy **Systems of classification**: Artificial, Natural and Phylogenetic: Bentham & Hooker's, Engler and Prantl's system and APG IV System (2016).-Merits and demerits of classification. **Herbaria and Botanical gardens:** Important herbaria and botanical gardens of the world and India. Technique of Herbarium Preparation. **Taxonomic literatures:** Floras, E-flora and Monograph.	

Unit 2:	15 hrs
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 (with sub Families: Papilionaceae,Caesalpinaceae and Mimisaceae), Cucurbitaceae, Apiaceae, Rubiaceae, Asteraceae, Apocynaceae, Lamiaceae, Euphorbiaceae, Arecaceae, and Poaceae. Plant Taxonomic Evidences: from Embryology, Cytology and Phytochemistry	
Unit 3:	**15 hrs**
Taxonomic Hierarchy: Concept of taxa (family, genus, species); Categories and taxonomic hierarchy; Species concepts (biological, morphological, evolutionary). Modes of speciation. **Botanical Nomenclature:** Principles and rules (ICN); Latest code –brief account, 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**
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 genes (rbcL) and one nuclear gene (nuclear ribosomal 18s DNA).	

Pedagogy: Teaching and learning, Seminar, Assignments, etc

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

GENERAL PATTERN OF THEORY QUESTION PAPER FOR PLANT MORPHOLOGY AND TAXONOMY

(For Semester end Examination)

Time: 02 Hours **Max Marks: 60**

Part-A

I. Answer any 04 questions: **4 X 2 = 08 marks**

1.
2.
3.
4.
5.

Part-B

II. Answer any 04 questions: **4 X 5 = 20 marks**

6.
7.
8.
9.
10.

Part-C

III. Answer any 04 questions: **4 X 08 = 32 marks**

11.
12.
13.
14.
15.

Note:

1. Minimum 1 question from each unit
2. Last question under Part-C 08 may be split in to two of 4 marks each (4+4) if necessary
2. Proportionate weightage shall be given to each unit based on number of hours prescribed

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	**4 Hours per week**
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 of flower and its parts, Study of fruits. Floral diagram and floral formula
2	Study of families mentioned in theory with 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 Engler & Prantl's system of classification) **26 hrs**
3	Construction of plant phylogenetic trees using various loci (*atp*B, rbcL, ITS, trnL etc) with various phylogenetic methods (Neibour 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. Green gram, Horse gram, Black gram, Bengal gram, Tamarind, Bitter gourd, Coriander, Coffee, Ricinus, Coir, Arecanut, Ragi, *Catharanthus roses*, *Rauvolfia serpentaina,* **16 hrs**
5	**Field visit**: Local or outside area/ Botanical garden/ tribal settlements
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)

Pedagogy: Teaching and learning, conducting experiments, field visits

Formative Assessment for Practical *Compulsory as per guidelines*	
Assessment Occasion / Type	**Marks**
Attendance	05
Test	05
Field Visit	05
Submission(Tour report and Herbarium)	10
Total	**25 Marks**

QUESTION PAPER & SCHEME OF PRACTICAL EXAMINATION FOR PLANT MORPHOLOGY AND TAXONOMY

(For the Semester end examination)

Time:03Hours **Max Marks: 25**

1. Identify, classify and describe the specimen A, B & C taxonomically	3 X 3 = 9 Marks
2. Write the floral diagram and floral formal of the given specimen D	3 Marks
3. Identification of Specimen / Photocopy E, F and G	3 X 2 = 6 Marks
4. Viva Voce	2 Marks
5. Submission (Journal / Record +Study Tour Report)	5 Marks

General instructions:

Q1. Give 2 specimens from Dicotyledons (A) and 1 specimen from Monocotyledons (B)

Q2. Give specimen from family they studied (D)

Q3. Give 1 Specimen from Slides / materials from Root / Stem / Leaf / Inflorescence for (E), one Flower / Fruit for (F) and 1 specimen from Economic importance (G)

Q4. Viva - Based on Practical syllabus (Portion / specimen not given in practical examination)

Q5. Submission- Certified Class Record

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

References:

1. Baker. H.G.1970. Plant and Civilization, Wadsworth Publishing Company
2. Colton C.M.1997. Ethnobotany – Principles & applications. John Wiley & 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 A.K. Pandey, 1996.*Taxonomy and Plant Conservation.* C.B.S. Publishers & Distributors, New Delhi

13. Manilal, K.S. 2003. *Van Rheede's Hortus Malabaricus.English Edition*, with Annotations and Modern Botanical Nomenclature. (12Vols.) University of Kerala, Trivandrum

14. Naik V.N., *Taxonomy of Angiosperms*, 1991. Tata Mcgraw-Hill Pub. Co.Ltd., New Delhi.

15. Pandey,S.N &S.P.Misra (2008)-*Taxonomy of Angiosperms* -Ane Books India, New Delhi.

16. Radford A B, W C Dickison, J M Massey & C R Bell, *Vascular Plant Systematics*, 1974,Harper & Row Publishers, New York.

17. Singh G.2012. *Plant systematics: Theory & Practice*. Oxford & IBH, Pvt. Ltd., New Delhi

18. Singh V. & Jain - *Taxonomy of Angiosperms* - Rastogi Publications, Meerut.

19. Sivarajan V. V - *Introduction to Principles of taxonomy* - Oxford & I B H New Delhi.

20. Any local/state/regional flora published by BSI or any other agency

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	**60 Hours**	Duration of SEA/Exam	**2 hours**
Formative Assessment Marks	**40**	Summative Assessment Marks	**60**

Course Pre-requisite(s):	
	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	Classify Plant pollination methods
CO5	Recognition of modes of inheritance of traits/ phenotypes and Phenotype-genotype correlate

Contents	**60 hrs**
Unit 1:	**15 hrs**
Chromosomes: Morphology - Size, number, structure, classification. Autosomes, Allosomes. Karyotype and Idiogram. Nucleosome concept. Giant chromosomes: Lampbrush and salivary gland chromosomes. Chromosomal aberrations: aneuploidy-monoploidy, diploidy, polyploidy. Euploidy - monosomy, disomy, nullisomy, trisomy.Structural aberrations: Deletion, duplication, inversion and translocation. Sex linkage	
Unit 2:	**15 hrs**
Genetics: History of Mendel, terminologies, Principles and laws of inheritance, Chromosome theory of inheritance, incomplete dominance and co-dominance. Lethal alleles, Epistasis, supplementary and complimentary interactions. Pleiotropy, Genetic problems. Extra chromosomal Inheritance Chloroplast mutation: Variegation in Four o'clock plant; Mitochondrial mutations in yeast. Mutation: types, molecular basis of mutation, mutagens - physical and chemical. Detection of mutations: CIB method, role of transposons in mutation	

Unit 3:	15 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, Gene mutations. Types of mutations; Molecular basis of Mutations; Mutagens – physical and chemical (Base analogs, deaminating, alkylating and intercalating agents). Population and Evolutionary Genetics, Hardy-Weinberg Law, role of natural selection, genetic drift. Genetic variation and Speciation.	
Unit 4:	**15 hrs**
Plant Breeding: Introduction and objectives. Breeding systems. Important achievements and undesirable consequences of plant breeding. Methods of crop improvement: Introduction, centres of origin and domestication of crop plants, plant genetic resources, acclimatization. Hybridization: Procedure, advantages and limitations. Inbreeding depression and heterosis history, genetic basis of inbreeding depression and heterosis; Applications. Role of biotechnology in mutation and crop improvement.	

Pedagogy: Teaching and learning, Seminar, Assignments etc

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

GENETICS AND PLANT BREEDING (Practical)			
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	
1	Mendel's laws through seed ratios. Laboratory exercises in probability and chi-square
2	Chromosome mapping using point test cross data.
3	Study of Karyotype, Salivary gland chromosome and Lamp brush chromosome
4	Photographs / Permanent Slides showing Translocation Ring and Inversion Bridge
5	Problems related to topics prescribed under Genetics
6	Artificial vegetative propagation: cutting, layering, grafting and gootee
7	Natural vegetative propagation: Rhizome, bulb, corm
8	Study of Pollen viability test
9	Study of emasculation technique

Pedagogy: Teaching and learning, conducting experiments, field / Laboratory visits

Formative Assessment for Practical ***Compulsory as per guidelines***	
Assessment Occasion / Type	**Marks**
Attendance	05
Test	05
Field Visit	05
Submission- Assignment	10
Total	**25 Marks**

GENERAL PATTERN OF THEORY QUESTION PAPER FOR GENETICS AND PLANT BREEDING

(For Semester end Examination)

Time: 02 Hours **Max Marks: 60**

Part-A

I. Answer any 04 questions: **4 X 2 = 08 marks**

1.
2.
3.
4.
5.

Part-B

II. Answer any 04 questions: **4 X 5 = 20 marks**

6.
7.
8.
9.
10.

Part-C

III. Answer any 04 questions: **4 X 08 = 32 marks**

11.
12.
13.
14.
15.

Note:

1. Minimum 1 question from each unit
2. Last question under Part-C 08 may be split in to two of 4 marks each (4+4) if necessary
2. Proportionate weightage shall be given to each unit based on number of hours prescribed

PRACTICAL EXAMINATION QUESTION PAPER & SCHEME FOR GENETICS AND PLANT BREEDING

(For the Semester end examination)

Time: 03Hours **Max Marks: 25**

1. Perform the emasculation / pollen viability / fertility of the given sample **A**	**3** Marks
2. Solve the given Genetic problem **B** and write the suitable ratio	5 Marks
3. Identify the specimen / photocopy/ slide **C** and **D**	4 X 2 = 8 Marks
4. Viva Voce	4 Marks
5. Submission of certified class Record	5 Marks

General instructions:

Q1. (A) Material Cassia / Hibiscus / Any locally available material
Q2. (B) Any problem related to Mendelism and Mendelian deviation
Q3. (**C**) and (**D**) Down's, Klinefelter's and Turner's syndromes, Translocation Ring and Inversion Bridge
Q4. Viva voce: Based on Practical syllabus (Portion / specimen not given in practical examination)
Q6. Submission- Certified Class Record

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

References

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	**B.Sc. in BOTANY**	Semester	VI
Course Title	**Cell Biology (Theory)**		
Course Code	**DSC – BOT-C13 - T**	No. of Credits	**04**
Contact hours	**60 Hours**	Duration of SEA/Exam	**2 hours**
Formative Assessment Marks	**40**	Summative Assessment Marks	**60**

Course Pre-requisite(s):	
	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 bio molecules (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	**60 hrs**
Unit 1:	**15 hrs**
Cell: Cell wall, chemical composition, functions and variations in prokaryotic and eukaryotic cells (primary and secondary wall), Glycocalyx, pit connections. Cell membrane: Structure and functions, active and passive transport, proton pumps associated (Na-K, Cacal modulin etc. and their distribution), phagocytosis, pinocytosis, exocytosis.	
Unit 2:	**15 hrs**
Cell organelles; Structural organization and functional marker enzymes of Mitochondria, Endoplasmic Reticulum, Chloroplasts, Golgi Apparatus, Lysosomes. Biogenesis of mitochondria and chloroplasts. Brief account of transport in Mitochondria and Chloroplast (Tim/Tom). Targeting and insertion of proteins in ER. Sorting and export of protein from Golgi Apparatus	

Unit 3:	15hrs
Nucleus: Nuclear envelope, structure of nuclear pore complex, nuclear lamina, transport across nuclear membrane, Nucleolus. Cell cycle: Phases of eukaryotic cell cycle, mitosis and meiosis; Regulation of cell cycle- check points, role of protein kinases. Causes of cancer, role of mitosis in causing cancer, Programmed cell death	
Unit 3:	**15hrs**
Genetic material: Introduction, discovery, chemical nature, structure and replication of genetic material, genetic code, non-genetic RNA, Biosynthesis of proteins, Regulation of gene action in prokaryotes (Lac Operan concept), Gene regulation in eukaryotes	

Pedagogy: Teaching and learning, Seminar, Assignments etc

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

CELL BIOLOGY (Practical)			
Program Name	**B.Sc. in BOTANY**	Semester	**VI**
Course Title	**CELL BIOLOGY (Practical)**	Practical Credits	**02**
Course Code	**DSC – BOT – C14 - P**	Contact Hours	**4 Hours per week**
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
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)
5	Isolation of cell organelle – Chloroplast
6	Isolation of DNA from Onion leaf

Pedagogy: Teaching and learning, conducting experiments, field / Laboratory visits

Formative Assessment for Practical ***Compulsory as per guidelines***	
Assessment Occasion / Type	**Marks**
Attendance	05
Test	05
Field Visit	05
Submission- Assignment	10
Total	**25 Marks**

GENERAL PATTERN OF THEORY QUESTION PAPER FOR CELL BIOLOGY

(For Semester end Examination)

Time: 02 Hours **Max Marks: 60**

Part-A

I. Answer any 04 questions: **4 X 2 = 08 marks**

1.
2.
3.
4.
5.

Part-B

II. Answer any 04 questions: **4 X 5 = 20 marks**

6.
7.
8.
9.
10.

Part-C

III. Answer any 04 questions: **4 X 08 = 32 marks**

11.
12.
13.
14.
15.

Note:

1. Minimum 1 question from each unit
2. Last question under Part-C 08 may be split in to two of 4 marks each (4+4) if necessary
2. Proportionate weightage shall be given to each unit based on number of hours prescribed

PRACTICAL EXAMINATION QUESTION PAPER & SCHEME FOR CELL BIOLOGY

(For the Semester end examination)

Time: 03Hours **Max Marks: 25**

1. Preparation of squash / smear of material **A**, identify, Sketch and label any two stages with reasons 06 marks
2. Find out cell length and breadth of the given material **B** using micrometry 04 marks
3. Identify the slides **C** & **D** 04 marks
4. Viva-voce 04 marks
5. Submission (Record + 5 Permanent slides) 05+02 marks

General instructions:

Q1. (A) Give specimen from Onion/ Rhoeo

Q2. (B) Give specimen from Onion/ Rhoeo leaf

Q3. (C) Permanent slide from mitosis & (D) meiosis / Photocopies of Cell organelles

Q4. Viva-voce Based on Practical syllabus (Portion / specimen not given in practical examination)

Q5. Submission (Record + 5 slides)

References

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. De Robertis, E. D. P. and De Robertis R. E. 2009. Cell and Molecular Biology, 8th edition. LippincottWilliams and Wilkins, Philadelphia.
3. Becker W. M., Kleinsmith L.J. and Bertni G. P. 2009. The World of the Cell. 7th edition. Pearson Benjamin Cummings Publishing, San fransisco.
4. Reven, F.H., Evert, R.F., Eichhorn, S.E. (1992). Biology of Plants. New York, NY: W.H.Freeman and Company
5. 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.
6. Raven, F.H., Evert, R. F., Eichhorn, S.E. (1992).Biology of Plants. New York, NY: W.H. Freeman and Co.
7. Verma, P. S. (2004). Cell Biology,Genetics, Molecular Biology: Evoloution and Ecology. India: S. Chand Limited.

PLANT PHYSIOLOGY AND PLANT BIOCHEMISTRY (THEORY)

Program Name	**B.Sc. in BOTANY**	Semester	VI
Course Title	**Plant Physiology & Plant Biochemistry (Theory)**		
Course Code	**BOT-C15 - T**	No. of Credits	**04**
Contact hours	**60 Hours**	Duration of SEA/Exam	**2 hours**
Formative Assessment Marks	**40**	Summative Assessment Marks	**60**

Course Pre-requisite(s):	
	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 bio molecules
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	**60 hrs**
Unit 1:		**15 hrs**
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: Active and passive methods, Radial transport of water, Factors affecting water absorption. Transpiration: Types and process, Structure of Stomatal apparatus, Mechanism of guard cell movement: K+ ion transport theory, Anti transpirants, Guttation. Mechanism of ascent of sap: Vital theories- Root pressure and pulsatory theories. Physical force theories-Transpiration pull theory. Phloem Transport: Transport of organic solutes. Path of transport, vein loading and unloading. Mass flow hypothesis. Mineral nutrition: A brief account on Micro nutrients: zinc, boran, molybdenum and macro nutrients: Nitrogen, phosphorus, Potash		

Unit 2:	15 hrs
Bioenergetics: **Photosynthesis:** Photosynthetic Pigments (Chlorophyll a, b, xanthophylls, and carotene); Photosystem I and II, reaction centre, antenna molecules; Light reaction: Electron transport and mechanism of ATP synthesis. Dark reaction: C3, C4 and CAM pathways of carbon fixation, Photorespiration. **Respiration**: Glycolysis, anaerobic respiration, TCA cycle; Oxidative phosphorylation, Glyoxylate, Respiratory quotient: protein, carbohydrate, lipid **Nitrogen metabolism:** Biological nitrogen fixation	
Unit 3:	**15 hrs**
Plant Harmones and Movements: Definition and classification of plant Hormones influence on plant growth development of: Auxins, Gibberlins, Cytokinins, ABA and Ethylene. Brief account of Senescence, Synthetic growth regulators and their effect on plant growth and development. Practical utility in agriculture and horticulture. Sensory Photobiology: Photoperiodism, function & structure of Phytochromes, Phototropin & Cryptochromes. Plant Movements: Phototropism, Geotropism, Hydrotropism and Seismonasty	
Unit 4:	**15 hrs**
Enzymes - Properties, classification and mechanism of action. Factors affecting enzyme action. Carbohydrates: classification and function. Proteins: Classification, structure - primary, secondary, tertiary and quaternary Vitamins: Classification, source, functions and deficiency symptoms. Lipids: Classification and function. Secondary plant products: Terpenes, alkoloids and phenolics	

Pedagogy: Teaching and learning, Seminar, Assignments etc

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

PLANT PHYSIOLOGY AND PLANT BIOCHEMISTRY (Practical)

Program Name	**B.Sc. in BOTANY**	Semester	**VI**
Course Title	**Plant Physiology and Plant Biochemistry (Practical)**	Practical Credits	**02**
Course Code	**BOT – C16 - P**	Contact Hours	**4 Hours per week**
Formative Assessment	**25 Marks**	Summative Assessment	**25 Marks**

Practical Content

1	Experiment to demonstrate the phenomenon of exosmosis and endosmosis
2	To determine the osmotic pressure of the cell sap by Plasmolytic method
3	To determine the Stomatal Index
4	To demonstrate root pressure / transpiration pull in plants.
5	To compare the rate of transpiration from the two surfaces of leaf by cobalt chloride paper method
6	To demonstrate that oxygen is liberated in the process of photosynthesis
7	Separation of photosynthetic pigments by paper chromatography and measure their Rf values.
8	Study of Phototrophism
9	Qualitative test for Starch, Protein, Reducing Sugars and Lipids

Pedagogy: Teaching and learning, conducting experiments, field / Laboratory visits

Formative Assessment for Practical

Compulsory as per guidelines

Assessment Occasion / Type	**Marks**
Attendance	05
Test	05
Field Visit	05
Submission- Assignment	10
Total	**25 Marks**

GENERAL PATTERN OF THEORY QUESTION PAPER FOR PLANT PHYSIOLOGY AND PLANT BIOCHEMISTRY

(For Semester end Examination)

Time: 02 Hours **Max Marks: 60**

Part-A

I. Answer any 04 questions: **4 X 2 = 08 marks**

1.
2.
3.
4.
5.

Part-B

II. Answer any 04 questions: **4 X 5 = 20 marks**

6.
7.
8.
9.
10.

Part-C

III. Answer any 04 questions: **4 X 08 = 32 marks**

11.
12.
13.
14.
15.

Note:

1. Minimum 1 question from each unit
2. Last question under Part-C 08 may be split in to two of 4 marks each (4+4) if necessary
2. Proportionate weightage shall be given to each unit based on number of hours prescribed

PRACTICAL EXAMINATION QUESTION PAPER & SCHEME FOR PLANT PHYSIOLOGY AND PLANT BIOCHEMISTRY

(For the Semester end examination)

Time: 03Hours **Max Marks: 25**

1. Conduct the experiment **A** and leave the preparation for inspection	05 marks
2. Comment on minor experiment **B & C**	3 X 2 = 6 marks
3. Conduct micro chemical test **D**	03 marks
4. Viva-voce	04 marks
5. Submission of Class Record + Industrial visit report	05 +2=7 marks

General instructions:

Q1. (A) Osmotic potential, Paper chromatography,

Q2. (B) & (C) Exosmosis, endosmosis, transpiration pull, cobalt chloride experiment, Bubble count experiment, Phototropism

Q3. (D) Qualitative test for Starch, Protein, Reducing Sugars and Lipids

Q4. Viva-voce Based on Practical syllabus (Portion / specimen not given in practical examination)

Q5. Submission (Record + Industrial visit report)

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.

INTERNSHIP FOR GRADUATE PROGRAMME (AS PER UGC & AMP; AICTE)

Course title Internship Discipline specific

No of contact hours 90

No of credits 2

Method of evaluation Presentations / Report submission /Activity etc.,

1. Internship shall be Discipline Specific of 90 hours (2 credits) with duration of 4-6 weeks.
2. Internship may be full-time / part-time (full-time during semester holidays and part-time in the academic session)
3. Internship mentor/supervisor shall avail work allotment during 6th semester for a Maximum of 20 hours
4. The student should submit the final internship report (90 hours of Internship) to the Mentor for completion of the internship
5. The detailed guidelines and formats shall be formulated by the universities separately as prescribed in accordance to UGC and AICTE guidelines.
6. **BOS resolved to adopt and to formulate the structure for Graduate Internship Programme after getting the suitable guidelines from the University**