

ANDHRA PRADESH STATE COUNCIL OF HIGHER EDUCATION

(A Statutory body of the Government of Andhra Pradesh)

REVISED UG SYLLABUS UNDER CBCS

(Implemented from Academic Year 2020-21)

PROGRAMME: FOUR YEAR B.Sc. (Hons)

Domain Subject: BOTANY

Skill Enhancement Courses (SECs) for Semester V, from 2022-23 (Syllabus with Learning Outcomes, References, Co-curricular Activities & Model Q.P. Pattern)

Structure of SECs for Semester – V

(To choose One pair from the Four alternate pairs of SECs)

Univ. Code	Course NO. 6 & 7	Name of Course	Th. Hrs. / Week	IE Mar-ks	EE Mar-ks	Credits	Prac. Hrs./ Wk	Mar-ks	Credits
	6A	Plant Propagation	3	25	75	3	3	50	2
	7A	Seed Technology	3	25	75	3	3	50	2

OR

	6B	Vegetable Crops – Cultivation Practices	3	25	75	3	3	50	2
	7B	Vegetable Crops – Post Harvest Practices	3	25	75	3	3	50	2

OR

	6C	Plant Tissue Culture	3	25	75	3	3	50	2
	7C	Mushroom Cultivation	3	25	75	3	3	50	2

OR

	6D	Gardening and Landscaping	3	25	75	3	3	50	2
	7D	Agroforestry	3	25	75	3	3	50	2

Note-1: For Semester–V, for the domain subject Botany, any one of the four pairs of SECs shall be chosen as courses 6 and 7, i.e., 6A & 7A or 6B & 7B or 6C & 7C or 6D & 7D. The pair shall not be broken (ABCD allotment is random, not on any priority basis).

Note-2: One of the main objectives of Skill Enhancement Courses (SEC) is to inculcate skills related to the domain subject in students. The syllabus of SEC will be partially skill oriented. Hence, teachers shall also impart practical training to students on the skills embedded in syllabus citing related real field situations.

A.P. State Council of Higher Education
Semester-wise Revised Syllabus under CBCS, 2020-21

Course Code:

Four-year B.Sc. (Hons)
Domain Subject: **BOTANY**
IV Year B. Sc. (Hons) – Semester – V

Max Marks: 100

Course-6A: Plant Propagation

(Skill Enhancement Course (Elective), Credits: 05)

I. Learning Outcomes:

Students at the successful completion of the course will be able to:

1. Explain various plant propagation structures and their utilization.
2. Understand advantages and disadvantages of vegetative, asexual and sexual plant propagation methods.
3. Assess the benefits of asexual propagation of certain economically valuable plants using apomictics and adventive polyembryony.
4. Demonstrate skills related to vegetative plant propagation techniques such as cuttings, layering, grafting and budding.
5. Apply a specific macro-propagation technique for a given plant species.

II. Syllabus: (Hours: Teaching: 50, Lab: 30, Field training: 05, others incl. unit tests: 05)
(*Syllabi of theory, practical and lab (skills) training together shall be completed in 80 hours*)

Unit – 1: Basic concepts of propagation (10h)

1. Propagation: Definition, need and potentialities for plant multiplication; asexual and sexual methods of propagation - advantages and disadvantages.
2. Propagation facilities: Mist chamber, humidifiers, greenhouses, glasshouses, cold frames, hot beds, poly-houses, phytotrons nursery - tools and implements.
3. Identification and propagation by division and separation: Bulbs, pseudobulbs, corms, tubers and rhizomes; runners, stolons, suckers and offsets.

Unit – 2: Apomictics in plant propagation (10h)

1. Apomixis: Definition, facultative and obligate; types – recurrent, non-recurrent, adventitious and vegetative; advantages and disadvantages.
2. Polyembryony: Definition, classification, horticultural significance; chimera and bud sport.
3. Propagation of mango, *Citrus* and *Allium* using apomictic embryos.

Unit – 3: Propagation by cuttings (10h)

1. Cuttings: Definition, different methods of cuttings; root and leaf cuttings.

2. Stem cuttings: Definition of stem tip and section cuttings; plant propagation by herbaceous, soft wood, semi hard wood, hard wood and coniferous stem cuttings.
3. Physiological and bio chemical basis of rooting; factors influencing rooting of cuttings; Use of plant growth regulators in rooting of cuttings.

Unit – 4: Propagation by layering (10h)

1. Layering: Definition, principle and factors influencing layering.
2. Plant propagation by layering: Ground layering – tip layering, simple layering, trench layering, mound (stool) layering and compound (serpentine layering).
3. Air layering technique – application in woody trees.

Unit – 5: Propagation by grafting and budding (10h)

1. Grafting: Definition, principle, types, graft incompatibility, collection of scion wood stick, scion-stock relationship, and their influences, bud wood certification; micrografting.
2. Propagation by veneer, whip, cleft, side and bark grafting techniques.
3. Budding: Definition; techniques of ‘T’, inverted ‘T’, patch and chip budding.

III. References:

1. Sharma RR and Manish Srivastav.2004. Plant Propagation and Nursery Management International Book Distributing Co. Lucknow.
2. Hartman, HT and Kester, D.E.1976. Plant Propagation: Principles and Practices, Prentice Hall of India Pvt. Ltd. Bombay.
3. Sadhu, M.K. 1996. Plant Propagation. New Age International Publishers, New Delhi.
4. Web resources suggested by the teacher concerned and college librarian including reading material.

Course -6A: Plant Propagation - Practical syllabus

IV. Learning Outcomes: On successful completion of this practical course, student will be able to:

1. Make use of different plant propagation structures for plant multiplication.
2. Explore the specialized organs or asexual propagules in some plants for their proliferation.
3. Demonstrate skills on micropropagation of plants through vegetative propagation techniques.
4. Evaluate and use a suitable propagation technique for a given plant species.

V. Practical (Laboratory) syllabus: (30hrs): The following experiments/practices shall be conducted by students in the lab.

1. Preparation of nursery beds – flat, raised and sunken beds.
2. Propagation through apomictic.
3. Propagation by separation and division technique.

4. Propagation by cuttings.
5. Propagation by layering
6. Propagation by grafting.
7. Propagation by budding.
8. Preparation of potting mixture, potting and repotting.

VI. Lab References:

1. Prasad, V. M. and Balaji Vikram, 2018. Practical Manual on Fundamentals of Horticulture and Plant Propagation, Write & Print Publications, New Delhi
2. Upadhyay S. K. (Ed.) 2013. Practical Manual Basic Horticulture-I, Akashdeep Printers, New Delhi
3. Web sources suggested by the teacher concerned.

VII. Co-Curricular Activities:

a) Mandatory: (*Lab/field training of students by teacher: (Lab: 10 + field: 05 hours):*)

1. **For Teacher:** Training of students by the teacher in the laboratory/field for a total of not less than 15 hours on the field techniques/skills of different plant propagation structures, containers, preparation of soil, plant propagation through separation and division, apomictics, cuttings, layering, grafting and budding.
2. **For Student:** Students shall (individually) visit horticulture nurseries in a University/, research institute /private nursery and observe propagation structures, propagation techniques etc., write their observations and submit a hand-written Fieldwork/Project work/Project work Report not exceeding 10 pages in the given format to the teacher.
3. Max marks for Fieldwork/Project work Report: 05.
4. Suggested Format for Fieldwork/Project work Report: Title page, student details, index page, details of place visited, observations, findings and acknowledgements.
5. Unit tests (IE).

b) Suggested Co-Curricular Activities:

1. Training of students by experts in plant vegetative propagation methods.
2. Assignments (including technical assignments like identifying propagation structures and their operational techniques for a specific plant species.
3. Seminars, Group discussions, Quiz, Debates etc. (suggested topics):
4. Preparation of videos on plant propagation techniques in relation to different economically useful plants.
5. Collection of material/figures/photos related to plant propagation methods, writing and organizing them in a systematic way in a file.
6. Visits to Horticulture/Agriculture/Forest nurseries, research organizations, universities etc.
7. Invited lectures and presentations on related topics by experts in the specified area.

Model Question Paper pattern for Practical Examination

Semester – V/ Botany Skill Enhancement Course

Course -6A: Plant Propagation

Max. Time: 3 Hrs.

Max. Marks: 50

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| 1. Demonstration plant propagation using separation and division /apomictics ‘A’ | 10 |
| 2. Demonstration plant propagation using cuttings/layering technique ‘B’ | 10 |
| 3. Demonstration of plant propagation using grafting/budding technique ‘C’ | 10 |
| 4. Scientific observation and data analysis | 4 x 3 = 12 |
| D. Plant propagation structure model/photograph | |
| E. Plant Growth Regulator | |
| F. Nursery bed model /photograph | |
| G. Asexual propagule/container/pot mixture for propagation | |
| 5. Record + Viva-voce | 5+3 = 8 |

A.P. State Council of Higher Education
Semester-wise Revised Syllabus under CBCS, 2020-21

Course Code:

Four-year B.Sc. (Hons)
Domain Subject: **BOTANY**
IV Year B. Sc. (Hons) – Semester – V

Max Marks: 100

Course-7A: Seed Technology

(Skill Enhancement Course (Elective), Credits: 05)

I. Learning outcomes:

Students at the successful completion of the course will be able to:

1. Explain the causes for seed dormancy and methods to break dormancy.
2. Understand critical concepts of seed processing and seed storage procedures.
3. Acquire skills related to various seed testing methods.
4. Identify seed borne pathogens and prescribe methods to control them.
5. Understand the legislations on seed production and procedure of seed certification.

II. Syllabus: (Hours: Teaching: 50, Lab: 30, Field training: 05, others incl. unit tests: 05)
(*Syllabi of theory, practical and lab (skills) training together shall be completed in 80 hours*)

Unit - 1: Seed dormancy (10h)

1. Seed and grain: Definitions, importance of seed; structure of Dicot and Monocot seed.
2. Role and goals of seed technology; characteristics of quality seed material.
3. Dormancy: Definition, causes for seed dormancy; methods to break seed dormancy.

Unit – 2: Seed processing and storage (10h)

1. Principles of seed processing: seed pre-cleaning, precuring, drying, seed extraction; cleaning, grading, pre-storage treatments; bagging and labelling, safety precautions during processing.
2. Seed storage; orthodox and recalcitrant seeds, natural longevity of seeds.
3. Factors affecting longevity in storage; storage conditions, methods and containers.

Unit – 3: Seed testing (10h)

1. Definition of seed vigour, viability and longevity; seed sampling and equipment; physical purity analysis.
2. Seed moisture – importance – methods of moisture determination.
3. Seed germination tests using paper, sand or soil – standard germination test; TZ test to determine seed viability; seed health testing.

Unit – 4: Seed borne diseases (10h)

1. A brief account of different seed borne diseases and their transmission.
2. Different seed health testing methods for detecting microorganisms.
3. Management of seed borne diseases; seed treatment methods: spraying and dusting.

Unit – 5: Seed certification

(10h)

1. Objectives - Indian seed Act; seed rules and seed order; new seed policy (1988).
2. Seed Inspector: Duties and responsibilities; classes of seeds, phases of certification standards (i.e., Land requirement, isolation distance) etc.
3. Issue of certificates, tags and sealing; pre and post control check: Genetic purity verification, certification, records and reporting.

III. References:

1. Umarani R, Jerlin R, Natarajan N, Masilamani P, Ponnuswamy AS 2006. Experimental Seed Science and Technology, Agrobios, Jodhpur
2. Agrawal, 2005. Seed Technology. Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi
3. Desai B D 2004. Seeds Hand Book: Processing and Storage, CRC Press
4. Agarwal V K and J B Sinclair 1996, Principles of Seed Pathology, CRC Press
5. Tunwar NS and Singh SN. 1988. Indian Minimum Seed Certification Standards. CSCB, Ministry of Agriculture, New Delhi.
6. McDonald, M.B. and L.O. Copland. 1999. Seed Science and Technology Laboratory Manual. Scientific Publishers, Jodhpur
7. Web resources suggested by the teacher concerned and the college librarian including reading material.

Course -7A: Seed Technology Practical syllabus

IV. Learning Outcomes: On successful completion of this practical course, student will be able to:

1. Demonstrate skills on various methods to break the seed dormancy.
2. Determine seed moisture, seed germination percentage, seed viability and vigour.
3. Identify the seed borne pathogens and prescribe methods to prevent or control them.
4. Evaluate various methods to produce healthy seeds.

V. Practical (Laboratory) syllabus: (30hrs)

1. Determination of physical properties of seeds of 3 select local crops (1 each from cereals, millets, pulses and oil seeds).
2. Breaking seed dormancy in 3 select local crops.
3. Measurement of seed moisture content by O S W A or moisture meter or oven drying method.
4. Seed germination tests and evaluation.
5. Seed vigour - conductivity test.
6. Accelerated ageing tests.
7. Tetrazolium test.
8. Priming and invigoration treatments for improving germination and vigour.

9. Techniques of seed health testing - visual examination of seeds, washing test, incubation methods, embryo count method, seed soak method for the detection of certain seed borne pathogens.
10. Using various types of tools for dusting and spraying pesticides/insecticides.

VI. Lab References:

1. Sanjeev Kumar, 2019. Practical Manual Seed Technology of Vegetable Crops, M/s Asian Printery, Ahmedabad
2. Divakara Sastry, E.V., Dharendra Singh and S.S.Rajput, 2013. Seed Technology: Practical Manual, Swami Keshwanand Rajasthan Agricultural University, Jobner
3. Web sources suggested by the teacher concerned.

VII. Co-Curricular Activities:

Mandatory: (*Lab/field training of students by teacher: (Lab: 10 + field: 05 hours)*)

1. **For Teacher:** Training of students by the teacher in the laboratory/field for a total of not less than 15 hours on the field techniques/skills of identifying and drawing seed structure, methods of breaking seed dormancy, seed cleaning, seed storage, identification of seed borne diseases, seed certification procedure.
2. **For Student:** Students shall (individually) visit horticulture/agriculture/ forest nursery/commercial seed production firms/ seed testing laboratories in government or private sector, observe seed production techniques, processing and storage, seed testing and certification procedures etc., write their observations and submit a hand-written Fieldwork/Project work Report not exceeding 10 pages in the given format to the teacher.
3. Max marks for Fieldwork/Project work Report: 05.
4. Suggested Format for Fieldwork/Project work Report: Title page, student details, index page, details of place visited, observations, findings and acknowledgements.
5. Unit tests (IE).

a) Suggested Co-Curricular Activities:

1. Training of students by experts in seed technology.
2. Assignments (including technical assignments like seed processing and storage techniques, seed testing, seed certification, seed borne diseases- prevention and control).
3. Seminars, Group discussions, Quiz, Debates etc. (suggested topics):
4. Preparation of videos on various aspects related to seed technology.
5. Collection of material/figures/photos related to seed technology, writing and organizing them in a systematic way in a file.
6. Visits to seed production units in Industries/Horticulture/Agriculture/Forest universities/colleges; research organizations, seed testing laboratories etc.
7. Invited lectures and presentations on related topics by experts in the specified area.

Model Question Paper pattern for Practical Examination

Semester – V/ Botany Skill Enhancement Course

Course – 7A: Seed Technology

Max. Time: 3 Hrs.

Max. Marks: 50

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| 1. Demonstration of a method to break seed dormancy 'A' | 10 |
| 2. Determination of seed moisture content/ seed germination test 'B' | 10 |
| 3. Demonstration of test for seed viability/ seed vigour 'C' | 10 |
| 4. Scientific observation and data analysis | 4 x 3 = 12 |
| D. Monocot / Dicot seed | |
| E. Seed sampling equipment | |
| F. Seed borne pathogen specimen/photograph | |
| G. Seed certification agency/procedure | |
| 4. Record + Viva-voce | 5+3 = 8 |

Course 6B: Vegetable Crops – Cultivation Practices
(Skill Enhancement Course (Elective), Credits: 05)

I. Learning Outcomes:

Students at the successful completion of the course will be able to:

1. Identify different vegetable plants and realize their value in human nutrition.
2. Analyse the types of soils to cultivate vegetable crops.
3. Demonstrate skills on agronomic practices for cultivation of vegetable crops.
4. Acquire knowledge on water, weed and disease managements in vegetable farming.
5. Comprehend aspects related to harvesting and storage of produce.

II. Syllabus: (Hours: Teaching: 50, Lab: 30, Field training: 05, others incl. unit tests: 05)
(*Syllabi of theory, practical and lab (skills) training together shall be completed in 80 hours*)

Unit – 1: Introduction to Olericulture (10h)

1. Vegetables and Olericulture: Definitions, nutritive value of vegetables and economic significance of vegetable farming.
2. Classification of vegetable crops (Botanical, based on climatic zones and economic parts used).
3. Types of vegetable gardens (kitchen gardening, terrace gardening, market gardening and truck gardening); implements used in vegetable gardening; vegetable forcing – a brief concept.

Unit – 2: Cultivation of leafy vegetables (10h)

1. Leafy vegetables: Definition and a brief account of locally cultivated crops.
2. Study of the following leafy vegetable crops: (a) *Amaranthus* (b) Palak (c) *Hibiscus cannabinus* (d) Fenugreek: systematic position, nutritive value, origin, area, production, improved varieties.
3. General cultivation practices such as sowing, planting distance, fertilizer requirements, irrigation, weed management, harvesting.
4. Crop specific yield, storage, disease and pest control and seed production.

Unit – 3: Cultivation of fruity vegetables (10h)

1. Fruity vegetables: Definition and a brief account of locally cultivated crops.
2. Study of the fruity vegetable crops: (a) Okra (b) Tomato (c) Chillies (d) Brinjal: systematic position, nutritive value, origin, area, production, improved varieties.
3. General cultivation practices such as sowing, planting distance, fertilizer requirements, irrigation, weed management, harvesting.
4. Crop specific yield- storage, disease and pest control and seed production

Unit – 4: Cultivation of peas and beans (10h)

1. A brief account of locally cultivated peas and beans.

2. Study of the following crops: (a) *Dolichos* (b) Cluster bean (c) French bean: Systematic position, nutritive value, origin, area, production, improved Varieties.
3. General cultivation practices such as sowing, planting distance, fertilizer requirements, irrigation, weed management, harvesting.
4. Crop specific yield, storage, disease and pest control and seed production.

Unit – 5: Cultivation of root and tuber crops (10h)

1. A brief account of locally cultivated root and tuber crops.
2. Study of the following crops: (a) Carrot (b) Radish (c) Sweet potato (d) Potato: Systematic position, family, nutritive value, origin, area, production, improved varieties.
3. General cultivation practices such as sowing, planting distance, fertilizer requirements, irrigation, weed management, harvesting.
4. Crop specific yield, storage, disease and pest control and seed production.

III. References:

1. Bose T K et al. (2003) Vegetable crops, Naya Udhog Publishers, Kolkata.
2. Singh D K (2007) Modern vegetable varieties and production, IBN Publisher Technologies, International Book Distributing Co, Lucknow.
3. Premnath, Sundari Velayudhan and D P Sing (1987) Vegetables for the tropical region, ICAR, New Delhi
4. Shanmugavelu, K. G. 1989. Production Technology of Vegetable Crops. Oxford and IBH Publishing Co. Pvt. Ltd. New Delhi.
5. Rana MK. 2008. Scientific Cultivation of Vegetables. Kalyani Publ., New Delhi
6. Rubatzky VE and Yamaguchi M. (Eds.). 1997. World Vegetables: Principles, Production and Nutritive Values. Chapman & Hall, London.
7. Web resources suggested by the teacher concerned and the college librarian including reading material.

Course 7B: Vegetable Crops – Cultivation Practices – Practical syllabus

IV. Learning Outcomes: On successful completion of this practical course, student will be able to:

1. List out, identify and handle different garden implements.
2. Identify the important vegetable crops grown in their locality.
3. Demonstrate various skills in cultivation of vegetable crops.
4. Identify pests, diseases and their remedies that are specific to a vegetable crop.

V. Practical (Laboratory) Syllabus: (30 hrs)

1. Identification of seeds of important local vegetable plants and preparation of herbarium.
2. Identification of local vegetable crops and handling of garden tools.
3. Analysis of garden soil for ratios of physical characteristics by sieve separation.
4. Determination of chemical characters of garden soil (pH, EC, Organic Carbon, SAR).
5. Planning and layout of a vegetable crop farm.

6. Preparation of nursery bed (raised, sunken and flat beds) and sowing of seeds.
7. Transplanting and care of vegetable seedlings.
8. Intercultural operations in vegetable plots.
9. Estimation of Total Soluble Solids (TSS) by Refractometer in a fruit and a leafy vegetable.
10. Estimation of Vitamin - C in a fruit and a leafy vegetable by DCIP method.
11. Identification of pests and disease-causing organisms on any two vegetable plants.
12. Seed extraction in tomato and brinjal.

VI. Lab References:

1. Akhilesh Sharma (Ed.), 2013. Practical Manual Olericulture-I, Sheel Packers, New Delhi
2. Biswajit Saha and Shri Dharampal Singh, 2013. Practical Manual Olericulture-I, Sheel Packers, New Delhi
3. Saini RS, K.D. Sharma, O.P, Dhankhar and R.A. Kaushik (Eds.). 2001. Laboratory Manual of Analytical Techniques in Horticulture. Agrobios, Jodhpur
4. Ranganna S. 1986. Handbook of Analysis and Quality Control for Fruit and Vegetable Products. Tata-McGraw Hill, New Delhi
5. Web sources suggested by the teacher concerned.

VII. Co-Curricular Activities:

a) Mandatory: (*Lab/ field training of students by teacher: (Lab: 10 + field: 05 hours)*)

1. **For Teacher:** Training of students by the teacher in the laboratory/field for a total of not less than 15 hours on the field techniques/skills of vegetable plants identification, vegetable gardening, agronomic practices, water, weed and disease management; harvesting and storage of produce.
2. **For Student:** Students shall (individually) visit a horticulture university/ research station or vegetable crop farm in their locality, observe different vegetable crops/ varieties of a vegetable crop, intercultural operations, pests and diseases, harvesting and storage etc., write their observations and submit to the teacher a hand-written Fieldwork/Project work Report not exceeding 10 pages in the given format.
3. Max marks for Fieldwork/Project work Report: 05.
4. Suggested Format for Fieldwork/Project work Report: Title page, student details, index page, details of place visited, observations, findings and acknowledgements.
5. Unit tests (IE).

b) Suggested Co-Curricular Activities:

1. Training of students by related industrial experts or farmers.
2. Assignments (including technical assignments like tools in vegetable gardening and their handling, agronomic practices, modern irrigation methods, organic farming practices etc.)
3. Seminars, Group discussions, Quiz, Debates etc. (on related topics).
4. Preparation of videos on cultivation practices for vegetable crops.
5. Collection of material/figures/photos related to different vegetable crop species, writing and organizing them in a systematic way in a file.

6. Visits to horticulture universities, research organizations, private vegetable farming units etc.
7. Invited lectures and presentations on related topics by field/industrial experts

Model Question Paper Pattern for Practical Examination

Semester – V/ Botany Skill Enhancement Course

Vegetable Crops – Cultivation Practices

Max. Time: 3 Hrs.

Max. Marks: 50

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| 1. Demonstration of nursery bed making/transplanting of seedlings ‘A’ | 8 |
| 2. Determination of physical or chemical characters of a given soil sample / Preparation of slide and identification of pest/disease-causing organism in plant part given ‘B’ | 10 |
| 3. Estimation of Total Soluble Solids/Vitamin-C in a given plant sample ‘C’ | 12 |
| 4. Scientific observation and data analysis | 4 x 3 = 12 |
| D. Identification of a garden tool | |
| E. Identification of seed/specimen of a vegetable crop species | |
| F. Identification of a weed/irrigation method | |
| G. Identification of a pest/disease causing organism | |
| 5. Record + Viva-voce | 5+3 = 8 |

Course 7B: Vegetable Crops – Post Harvest Practices
(Skill Enhancement Course (Elective), Credits: 05)

I. Learning Outcomes:

Students at the successful completion of the course will be able to:

1. Understand various practices for vegetable produce from harvesting to marketing.
2. Demonstrate skills on storage, processing and preservation of vegetables.
3. Summarize causes for spoilage of vegetables before and during storage and methods to prevent and control them.
4. Make use of preservation methods to reduce the loss of vegetable produce.
5. Explain about value added products, packaging and marketing of vegetables.

II. Syllabus: (Hours: Teaching: 50, Lab: 30, Field training: 05, others incl. unit tests: 05)
(*Syllabi of theory, practical and lab (skills) training together shall be completed in 80 hours*)

Unit – 1: Introduction to Post Harvest Practices (10h)

1. Post-harvest technology: Definition; importance, scope and future status of post-harvest management of vegetables.
2. Study of maturity standards of vegetables; harvest techniques of vegetables, methods stages, signs of harvesting; harvesting and its relationship with quality, sorting and grading.
3. Careful handling of harvested vegetables; pre-harvest and post-harvest factors responsible for ripening.

Unit – 2: Methods of storage (10h)

1. Climacteric and non-climacteric types of vegetables.
2. Methods of storage to prolong shelf life of harvested vegetables; on-farm storage, evaporatively cooled stores, ventilated storage, pit storage etc.
3. Refrigerated storage, refrigeration cycle, controlled and modified atmosphere, hypobaric storage.

Unit – 3: Processing of vegetables (10h)

1. Causes for spoilage of vegetables and control measures during storage; post-harvest disease and pest management.
2. Techniques to prevent deterioration; vegetable processing equipment; minimal processing of vegetables.
3. Safe chemicals and microbial limits; application of growth regulators for quality assurance; grading.

Unit -4: Preservation and value-addition (10h)

1. Importance and scope of vegetable preservation in India; principles underlying general methods of preservation.
2. Methods of preservation; food additives and food colours.

3. Fried products, process of frying; dried vegetables; sauces and chutneys, pickles and salted vegetables; by-product and waste utilization.

Unit – 5: Marketing

(10h)

1. Packing line operations, packaging of vegetables and their products; transportation; codex norms for export of perishables.
2. Demand supply analysis of important vegetables; market potential of various vegetables products.
3. Important marketing agencies and institutions; importance of cooperative marketing.

III. References:

1. Salunkhe DK and Kadam SS. (Ed.). 1998. Hand Book of Vegetable Science and Technology: Production, Composition, Storage and Processing. Marcel Dekker, New York.
2. Arthey D and Dennis C. 1996. Vegetable Processing. Blackie/Springer-Verlag, New York
3. Verma LR and Joshi VK. 2000. Post-harvest Technology of Fruits and Vegetables: Handling, Processing, Fermentation and Waste Management. Indus Publishing Company, New Delhi
4. Srivastava RP and Kumar S. 2003. Fruit and Vegetable Preservation: Principles and Practices. International Book Distribution Company, Lucknow.
5. Giridharilal GS, Siddappa and Tandon GL. 1986. Preservation of Fruits and Vegetables. ICAR, New Delhi.
6. Web resources suggested by the teacher concerned and the college librarian including reading material.

Course 7B: Vegetable Crops – Post harvest Practices – Practical syllabus

IV. Learning Outcomes: On successful completion of this practical course, student will be able to:

1. Identify stages of maturity in vegetable crops.
2. Handle material for storage of vegetables.
3. Identify physical and biological causes for spoilage of vegetables.
4. Make some value-added products of vegetables.

V. Practical (Laboratory) Syllabus: (30 hrs)

1. Maturity selection and harvest, harvesting practices.
2. List and cost of equipment, utensils, and additives required for small scale processing industry.
3. Study of different types of spoilages in fresh as well as processed vegetables.
4. Identification and classification of spoilage organisms.
5. Estimation of total carbohydrates (Anthrone method) in a stored vegetable and un-stored vegetable.
6. Estimation of protein (Lowry method) in a stored vegetable and un-stored vegetable.
7. Sensory evaluation of fresh and processed vegetables.
8. Assessment of quality and grading, pre-packaging and protective treatments.
9. Identification of packaging materials, containers for packaging.
10. Preparation of pickle from a vegetable.

11. Preparation of tomato sauce, ketchup and chutney.

VI. Lab References:

1. Swati Barche, Reena Nair and P. K. Jain, 2016. A Practical Manual on Post Harvest Value Addition and Processing of Horticulture Crops. Agrobios (India), Jodhpur
2. Antonio L. Acedo Jr., Md. Atiqur Rahman, Borarin Buntong and Durga Mani Gautam, 2016. Vegetable Postharvest Training Manual, AVRDC - The World Vegetable Center, Taiwan
3. Akhilesh Sharma (Ed.), 2013. Practical Manual Olericulture-I, Sheel Packers, New Delhi
4. Biswajit Saha and Shri Dharampal Singh, 2013. Practical Manual Olericulture-I, Sheel Packers, New Delhi
5. Web sources suggested by the teacher concerned.

VII. Co-Curricular Activities:

a) Mandatory: (*Lab/field training of students by teacher: (Lab: 10 + field: 05 hours)*)

1. **For Teacher:** Training of students by teacher in the laboratory/field for a total of not less than 15 hours on the field techniques/skills of harvesting indices of vegetables, storage methods, tools and techniques for processing, causes for spoilage and methods to control, preservation methods, marketing chain and in making value added products.
2. **For Student:** Students shall (individually) visit any one of the places like horticulture university/ research station; vegetable storage units in public and private sector; vegetable processing industries in their locality and observe harvesting practices, storage methods, processing and preservation; grading, value added products and marketing. Write their observations and submit to the teacher a hand-written Fieldwork/Project work Report not exceeding 10 pages in the given format.
3. Max marks for Fieldwork/Project work Report: 05.
4. Suggested Format for Fieldwork/Project work Report: Title page, student details, index page, details of place visited, observations, findings and acknowledgements.
5. Unit tests (IE).

b). Suggested Co-Curricular Activities:

1. Training of students by related industrial experts or farmers.
2. Assignments (including technical assignments like tools and techniques for storage, processing and preservation, causes for spoilage and methods to avoid losses, value added products of some vegetables, packaging and marketing etc.)
3. Seminars, Group discussions, Quiz, Debates etc. (on related topics).
4. Preparation of videos on cultivation practices for vegetable crops.
5. Collection of material/figures/photos related to harvesting, storage, processing and preservation of vegetable crop produce, writing and organizing them in a systematic way in a file.

6. Visits to horticulture universities, research organizations; storage, processing industries in public or private sector; industries making value added products of vegetables etc.
7. Invited lectures and presentations on related topics by field/industrial experts.

Model Question Paper Pattern for Practical Examination

Semester – V/ Botany Skill Enhancement Course

Vegetable Crops – Post Harvest Practices

Max. Time: 3 Hrs.

Max. Marks: 50

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- | | |
|--|------------|
| 1. Identification of organism(s) responsible for spoilage of vegetable ‘A’ | 8 |
| 2. Assessment of quality and grading/ technique of packaging and protective treatment. | 10 |
| 3. Estimation of carbohydrates/protein content in a vegetable sample ‘C’ | 12 |
| 4. Scientific observation and data analysis | 4 x 3 = 12 |
| D. Identification of harvesting stage | |
| E. Identification of equipment for processing | |
| F. Identification of PGR/chemical used for PHT of vegetables. | |
| G. Identification of a packaging material/value added product. | |
| 5. Record + Viva-voce | 5+3 = 8 |

Four-year B.Sc. (Hons)
Domain Subject: **BOTANY**
IV Year B. Sc. (Hons) – Semester – V

Max Marks: 100

Course 6C: Plant Tissue Culture
(Skill Enhancement Course (Elective), Credits: 05)

I. Learning Outcomes:

Students at the successful completion of the course will be able to:

1. Comprehend the basic knowledge and applications of plant tissue culture.
2. Identify various facilities required to set up a plant tissue culture laboratory.
3. Acquire a critical knowledge on sterilization techniques related to plant tissue culture.
4. Demonstrate skills of callus culture through hands on experience.
5. Understand the biotransformation technique for production of secondary metabolites.

II. Syllabus: (Hours: Teaching: 50, Lab: 30, Field training: 05, others incl. unit tests: 05)
(*Syllabi of theory, practical and lab (skills) training together shall be completed in 80 hours*)

Unit - 1: Basic concepts of plant tissue culture (10h)

1. Plant tissue culture: Definition, history, scope and significance.
2. Totipotency, differentiation, dedifferentiation, and redifferentiation; types of cultures.
3. Infrastructure and equipment required to establish a tissue culture laboratory.

Unit - 2: Sterilization techniques and culture media (10h)

1. Aseptic conditions – Fumigation, wet and dry sterilization, UV sterilization, ultrafiltration.
2. Nutrient media: Composition of commonly used nutrient culture media with respect to their contents like inorganic chemicals, organic constituents, vitamins, amino acids etc.
3. Composition and preparation of Murashige and Skoog culture medium.

Unit - 3: Callus culture technique (10h)

1. Explant: Definition, different explants for tissue culture: shoot tip, axillary buds, leaf discs, cotyledons, inflorescence and floral organs, their isolation and surface sterilization; inoculation methods.
2. Callus culture: Definition, various steps in callus culture.
3. Initiation and maintenance of callus - Growth measurements and subculture; somaclonal variations.

Unit – 4: Micropropagation (10h)

1. Direct and indirect morphogenesis, organogenesis, role of PGRs; somatic embryogenesis and synthetic seeds.
2. Greenhouse hardening unit operation and management; acclimatization and hardening of plantlets - need, process, packaging, exports.
3. Pathogen (Virus) indexing- significance, methods, advantages, applications.

Unit – 5: Applications of plant tissue culture (10h)

1. Germplasm conservation: cryopreservation methods, slow growth, applications and limitations; cryoprotectants.
2. Plant transformation techniques and bioreactors; production of secondary metabolites-optimization of yield, commercial aspects, applications, limitations.
3. Transgenic plants- gene transfer methods; BT cotton.

III. References:

1. Kalyan Kumar De (2001) An Introduction to Plant Tissue Culture, New Central Book Agency (P) Ltd., Calcutta
2. Razdan, M.K. (2005) Introduction to Plant Tissue Culture, Oxford & IBH Publishers, Delhi
3. Bhojwani, S.S. (1990) Plant Tissue Culture: Theory and Practical (a revised edition). Elsevier Science Publishers, New York, USA.
4. Vasil, I.K. and Thorpe, T.A. (1994) Plant Cell and Tissue Culture. Kluwer Academic Publishers, the Netherlands.
5. Web resources suggested by the teacher concerned and the college librarian including reading material.

Course 6C: Plant Tissue Culture – Practical syllabus

IV. Learning Outcomes: On successful completion of this practical course, student will be able to:

1. List out, identify and handle various equipment in plant tissue culture lab.
2. Learn the procedures of preparation of media.
3. Demonstrate skills on inoculation, establishing callus culture and Micro propagation.
4. Acquire skills in observing and measuring callus growth.
5. Perform some techniques related to plant transformation for secondary Metabolite production.

V. Practical (Laboratory) Syllabus: (30 hrs)

1. Principles and applications of- Autoclave, Laminar Airflow, Hot Air Oven.
2. Sterilization techniques for glass ware, tools etc.,
3. MS medium - Preparation of different stock solutions; media preparation
4. Explant preparation, inoculation and initiation of callus from carrot.
5. Callus formation, growth measurements.
6. Induction of somatic embryos, preparation of synthetic seeds.
7. Multiplication of callus and organogenesis.
8. Hardening and acclimatization in green house.

VI. Lab References:

1. Reinert, J. and M.M. Yeoman, 1982. Plant Cell and Tissue Culture - A Laboratory Manual, Springer-Verlag Berlin Heidelberg
2. Robert N. Trigiano and Dennis J. Gray, 1999. Plant Tissue Culture Concepts and Laboratory Exercises. CRC Press, Florida

4. Ashok Kumar, 2018. Practical Manual for Biotechnology, College of Horticulture & Forestry, Jhalawar, AU, Kota
5. Chawla, H.S., 2003. Plant Biotechnology: A Practical Approach, Nova Science Publishers, New York
6. Web sources suggested by the teacher concerned.

VII. Co-Curricular Activities:

a) Mandatory: (*Lab/field training of students by teacher: Lab: 10 + field: 05 hours*)

1. **For Teacher:** Training of students by teacher in the laboratory/field for a total of not less than 15 hours on the field techniques/skills of sterilization procedures, preparation of media, establishment of callus culture, growth measurements; morphogenesis and organogenesis; acclimatization and hardening of plantlets.
2. **For Student:** Students shall (individually) visit anyone of plant tissue culture laboratories in universities/research organizations/private facilities, write their observations on tools, techniques, methods and products of plant tissue culture; and submit a hand-written Fieldwork/Project work Report not exceeding 10 pages to the teacher in the given format.
3. Max marks for Fieldwork/Project work Report: 05
4. Suggested Format for Fieldwork/Project work Report: Title page, student details, index page, details of place visited, observations, findings and acknowledgements.
5. Unit tests (IE).

b) Suggested Co-Curricular Activities:

1. Training of students by related industrial experts.
2. Assignments (including technical assignments like identifying tools in plant tissue culture and their handling, operational techniques with safety and security, IPR)
3. Seminars, Group discussions, Quiz, Debates etc. (on related topics).
4. Preparation of videos on tools and techniques in plant tissue culture.
5. Collection of material/figures/photos related to products of plant tissue culture, writing and organizing them in a systematic way in a file.
6. Visits to plant tissue culture/biotechnology laboratories in universities, research organizations, private firms, etc.
7. Invited lectures and presentations on related topics by field/industrial experts

Model Question Paper Pattern for Practical Examination
Semester – V/ Botany Skill Enhancement Course
Plant Tissue Culture

Max. Time: 3 Hrs.

Max. Marks: 50

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|--|------------|
| 1. Demonstration of a sterilization technique 'A' | 8 |
| 2. Preparation of MS medium 'B' | 10 |
| 3. Demonstration of callus culture technique/growth measurements 'C' | 12 |
| 4. Scientific observation and data analysis | 4 x 3 = 12 |
| D. Tissue culture equipment /photograph | |
| E. Morphogenesis or organogenesis - photograph | |
| F. Bioreactor/Secondary metabolite | |
| G. Transgenic plant/photograph | |
| 5. Record + Viva-voce | 5+3 = 8 |

Four-year B.Sc. (Hons)
Domain Subject: **BOTANY**
IV Year B. Sc. (Hons) – Semester – V

Max Marks: 100

Course 7C: Mushroom Cultivation

(Skill Enhancement Course (Elective), Credits: 05)

I. Learning Outcomes:

Students at the successful completion of the course will be able to:

1. Understand the structure and life of a mushroom and discriminate edible and poisonous mushrooms.
2. Identify the basic infrastructure to establish a mushroom culture unit.
3. Demonstrate skills preparation of compost and spawn.
4. Acquire a critical knowledge on cultivation of some edible mushrooms.
5. Explain the methods of storage, preparation of value-added products and marketing.

II. Syllabus: (Hours: Teaching: 50, Lab: 30, Field training: 05, others incl. unit tests: 05)
(Syllabi of theory, practical and lab (skills) training together shall be completed in 80 hours)

Unit – 1: Introduction and value of mushrooms (10h)

1. Mushrooms: Definition, structure of a mushroom and a brief account of life cycle; historical account and scope of mushroom cultivation; difference between edible and poisonous mushrooms.
2. Morphological features of any four edible mushrooms, Button mushroom (*Agaric us Bosporus*), Milky mushroom (*Calocybe indica*), Oyster mushroom (*Pleurotus sajor-caju*) and Paddy straw mushroom (*Volvariella volvacea*).
3. Nutraceutical value of mushrooms; medicinal mushrooms in South India - *Ganoderma lucidum*, *Phellinus rimosus*, *Pleurotus florida* and *Pleurotus pulmonaris* – their therapeutic value; Poisonous mushrooms - harmful effects.

Unit – 2: Basic requirements of cultivation system (10h)

1. Small village unit and larger commercial unit; layout of a mushroom farm - location of building plot, design of farm, bulk chamber, composting, equipment and facilities, pasteurization room and growing rooms.
2. Compost and composting: Definition, machinery required for compost making, materials for compost preparation.
3. Methods of composting- long method of composting and short method of composting.

Unit – 3: Spawning and casing (10h)

1. Spawn and spawning: Definition, facilities required for spawn preparation; preparation of spawn substrate.
2. Preparation of pure culture, media used in raising pure culture; culture maintenance, storage of spawn.

3. Casing: Definition, Importance of casing mixture, Quality parameters of casing soil, different types of casing mixtures, commonly used materials.

Unit – 4: Mushroom cultivation (10h)

Raw material, compost, spawning, casing, cropping, and problems in cultivation (diseases, pests and nematodes, weed molds and their management strategies), picking and packing for any Four of the following mushrooms:

- (a) Button mushroom (b) Oyster mushroom (c) Milky mushroom and (d) Paddy straw mushroom

Unit – 5: Post harvest technology (10h)

1. Shelf life of mushrooms; preservation of mushrooms - freezing, dry freezing, drying and canning.
2. Quality assurance and entrepreneurship - economics of different types of mushrooms; value added products of mushrooms.
3. Management of spent substrates and waste disposal of various mushrooms.

III. References:

1. Tewari Pankaj Kapoor, S. C. (1988). Mushroom Cultivation. Mittal Publication, New Delhi.
2. Pandey R.K, S. K Ghosh, (1996). A Hand Book on Mushroom Cultivation. Emkey Publications
3. Nita Bhal. (2000). Handbook on Mushrooms (Vol. I and II). Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi
4. Pathak, V. N. and Yadav, N. (1998). Mushroom Production and Processing Technology. Agrobios, Jodhpur.
5. Tripathi, D.P. (2005) Mushroom Cultivation, Oxford & IBH Publishing Co. Pvt. Ltd, New Delhi.
6. Pathak V.N., Nagendra Yadav and Maneesha Gaur (2000), Mushroom Production and Processing Technology Vedams Ebooks Pvt. Ltd., New Delhi
7. Web resources suggested by the teacher concerned and the college librarian including reading material.

Course 7C: Mushroom Cultivation – Practical syllabus

IV. Learning Outcomes: On successful completion of this practical course, student will be able to:

1. Identify and discriminate different mushrooms based on morphology.
2. Understand facilities required for mushroom cultivation.
3. Demonstrate skills on preparation of spawn, compost and casing material.
4. Exhibit skills on various cultivation practices for an edible mushroom.

V. Practical (Laboratory) Syllabus: (30 hrs)

1. Identification of different types of mushrooms.
2. Preparation of pure culture of an edible mushroom.
3. Preparation of mother spawn.

4. Production of planting spawn and storage.
5. Preparation of compost and casing mixture.
6. Demonstration of spawning and casing.
7. Hands on experience on cropping and harvesting.
8. Demonstration of storage methods.
9. Preparation of value-added products.

VI. Lab References:

1. Sushma Sharma Sapna Thakur Ajar Nath Yadav, 2018. Mushroom Cultivation: A Laboratory Manual, Eternal University, Sirmour, H.P.
2. Kadhila-Muandingi, N.P., F. S. Mubiana and K. L. Halueendo, 2012. Mushroom Cultivation: A Beginners Guide, The University of Namibia
3. Gajendra Jagatap and Utpal Dey, 2012. Mushroom Cultivation: Practical Manual, LAMBERT Academic Publishing, Saarbrücken, Germany
4. Deepak Som, 2021. A Practical Manual on Mushroom Cultivation, P.K.Publishers & Distributors, Delhi
5. Web sources suggested by the teacher concerned.

VII. Co-Curricular Activities:

a) Mandatory: (*Lab/field training of students by teacher: Lab: 10 + field: 05 hours*)

1. **For Teacher:** Training of students by teacher in the laboratory/field for not less than 15 hours on the field techniques/skills of identification of edible and poisonous mushrooms, basic facilities of a mushroom culture unit, preparation of compost and spawn, cultivation practices of edible mushrooms, storage and marketing of produce.
2. **For Student:** Students shall (individually) visit mushroom culture units in universities/research organizations/private sector write their observations on infrastructure, cultivation practices and products of a mushroom culture unit etc., and submit to the teacher a hand-written Fieldwork/Project work Report not exceeding 10 pages in the given format.
3. Max marks for Fieldwork/Project work Report: 05.
6. Suggested Format for Fieldwork/Project work Report: Title page, student details, index page, details of place visited, observations, findings and acknowledgements.
4. Unit tests (IE).

b) Suggested Co-Curricular Activities:

1. Training of students by related industrial experts.
2. Assignments (including technical assignments like identifying various mushrooms, tools and techniques for culture, identification and control of diseases etc.,
3. Seminars, Group discussions, Quiz, Debates etc. (on related topics).
4. Preparation of videos on tools and techniques in mushroom culture.
5. Collection of material/figures/photos related to edible and poisonous mushrooms, cultivation of mushrooms in cottage industries, writing and organizing them in a systematic way in a file.
6. Visits to mushroom culture units in universities, research organizations, private firms, etc.
7. Invited lectures and presentations on related topics by field/industrial experts.

Model Question Paper Pattern for Practical Examination

Semester – V/ Botany Skill Enhancement Course

Mushroom Cultivation

Max. Time: 3 Hrs.

Max. Marks: 50

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|--|------------|
| 1. Demonstration of preparing pure culture/mother spawn 'A' | 8 |
| 2. Preparation method for planting spawn and storage/compost and casing material 'B' | 10 |
| 3. Demonstration of spawning and casing/storage and making a value-added product 'C' | 12 |
| 4. Scientific observation and data analysis | 4 x 3 = 12 |
| D. Edible/poisonous mushroom specimen/photograph | |
| E. Infrastructure/tool used in mushroom cultivation | |
| F. Material for compost/casing | |
| G. Storage practice/ a value-added product | |
| 5. Record + Viva-voce | 5+3 = 8 |

Course 6D: Gardening and Landscaping

(Skill Enhancement Course (Elective), Credits: 05)

I. Learning Outcomes:

Students at the successful completion of the course will be able to:

1. Acquire a critical knowledge about the aesthetic value, types and styles of gardens.
2. Perform field operations in a garden by understanding the role of a gardener.
3. Identify various ornamental plants and explain the growth habits.
4. Propagate garden plants through various propagation techniques.
5. Demonstrate skills of designing and developing a garden.

II. Syllabus: (Hours: Teaching: 50, Lab: 30, Field training: 05, others incl. unit tests: 05)
(*Syllabi of theory, practical and lab (skills) training together shall be completed in 80 hours*)

Unit -1: Basics of Gardening (10h)

1. Garden and gardening: Definitions, objectives and scope; types of gardens (domestic garden, flower garden, woodland garden, rock garden, water garden and herb and vegetable garden).
2. Speciality gardens (vertical garden, roof garden and scented garden); principles of gardening; garden components and adornments;
3. Styles of garden: formal, informal, free style and wild; some famous gardens of India.

Unit -2: Garden operations (10h)

1. Bio-aesthetic planning, eco-tourism, theme parks, indoor gardening, therapeutic gardening.
2. Gardening operations: soil laying, manuring, watering, management of pests and diseases and harvesting.
3. Lawn making, methods of designing rockery and water garden.

Unit-3: Ornamental plants (10h)

1. Ornamental plants: flowering annuals and perennials; climbers and creepers; shade and ornamental trees.
2. Bulbous and foliage ornamental plants; cacti and succulents; palms, ferns.
3. Bonsai: definition, types and styles, art of making bonsai.

Unit-4: Propagation techniques (10h)

1. Propagation of ornamental plants by rhizomes, corms tubers, bulbs and bulbils.
2. Vegetative propagation techniques – a brief account of cuttings, layering and grafting.
3. Types of seed beds; sowing of seeds and raising seedlings, transplanting of seedlings; growing plants in pots, potting and repotting.

Unit-5: Landscaping (10h)

1. Landscaping: definition, landscaping of parks and public gardens.
2. Urban planning and planting avenues; Landscaping highways and educational institutions; beautifying villages and colonies.
3. Computer Aided Designing (CAD) for outdoor and indoor-scaping.

III. References:

1. Bose T.K. and Mukherjee, D., 1972, Gardening in India, Oxford & IBH Publishing Co., New Delhi.
2. Sandhu, M.K. 1989 Plant Propagation, Wiley Eastern Ltd., Bengaluru.
3. Nambisan, K. M. P. 1992. Design Elements of Land Scape Gardening Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi.
4. Bose, T. K. Malti, R. G. Dhua, R. S and Das, P. 2004. Floriculture and Landscaping. Nayaprakash, Calcutta.
5. Arora, J.S. 2006. Introductory Ornamental Horticulture. Kalyani Publishers, Ludhiana.
6. Web resources suggested by the teacher concerned and the college librarian including reading material.

Course 6D: Gardening and Landscaping – Practical syllabus

IV. Learning Outcomes: On successful completion of this practical course, student will be able to:

1. Perform various skills related to gardening.
2. Identify the living and non-living components required for garden development.
3. Identify the pests and diseases of garden plants and control the same.
4. Demonstrate skills of making bonsai and developing lawn.
5. Make landscape design using CAD.

V. Practical (Laboratory) Syllabus: (30 hrs)

1. Preparation of beds for growing nursery of herbs, shrubs and trees.
2. Tools, implements and containers used for propagation and nursery techniques.
3. Identification of different ornamental plants.
4. Demonstration of types and styles of gardens using photos or videos.
5. Gardening operations: soil laying, manuring, watering.
6. Identification of pathogenic and non-pathogenic diseases of garden plants and grasses.
7. Propagation by cutting, layering, budding and grafting.
8. Planning and designing of gardens, functional uses of plants in the landscape.
9. Preparation of land for lawn and planting.
10. Exposure to CAD (Computer Aided Designing)
11. Demonstration of bonsai making.
12. Making of topiaries.

VI. Lab References:

1. Paul Wagland, 2011. Garden Landscaping Manual: A Step-by-Step Guide to Landscaping & Building Projects in Your Garden, Haynes Publishing UK
2. Misra Kaushal Kumar, 2016. Practical Manual of Horticulture, Biotech Books, Open Library.org
3. Hemla Naik, B., S.Y. Chandrashekhar and M. Jawaharlal, 2013. Principles of Landscape Gardening, TNAU, Agrimoon.Com.
4. Web sources suggested by the teacher concerned.

VII. Co-Curricular Activities:

a) Mandatory: (*Lab/field training of students by teacher: (Lab: 10 + field: 05 hours)*)

1. **For Teacher:** Training of students by the teacher in the laboratory/field for a total of not less than 15 hours on the field techniques/skills of garden operations, lawn making, art of bonsai, plant propagation methods, Using CAD.
2. **For Student:** Students shall (individually) visit the parks in public and private places, study the living and non-living elements of gardening – landscaping; write their observations (on various plants, growth habit, propagation, design of garden etc.,) and submit a hand-written Fieldwork/Project work Report not exceeding 10 pages in the given format to the teacher.
3. Max marks for Fieldwork/Project work Report: 05
4. Suggested Format for Fieldwork/Project work Report: Title page, student details, index page, details of place(s) visited, observations, findings, and acknowledgements.
5. Unit tests (IE).

b) Suggested Co-Curricular Activities:

1. Training of students by related industrial experts.
2. Assignments (including technical assignments like identifying ornamental plants, types and styles of gardens, propagation of garden plants, landscaping)
3. Seminars, Group discussions, Quiz, Debates etc. (on related topics).
4. Preparation of videos on plant propagation, garden operations, ornamental gardening.
5. Collection of material/figures/photos related to gardening and landscaping, writing and organizing them in a systematic way in a file.
6. Visits to gardens and parks in public places and/or private firms; famous gardens in A.P. and India etc.
7. Invited lectures and presentations on related topics by field/industrial experts.

Model Question Paper Pattern for Practical Examination

Semester – V/ Botany Skill Enhancement Course

Gardening and Landscaping

Max. Time: 3 Hrs.

Max. Marks: 50

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- | | |
|---|------------|
| 1. Demonstration a vegetative propagation technique 'A' | 8 |
| 2. Demonstration of bed making/ garden operations' 'B' | 10 |
| 3. Demonstration of bonsai technique/ designing a landscape 'C' | 12 |
| 4. Scientific observation and data analysis | 4 x 3 = 12 |
| D. Type or style of garden | |
| E. Ornamental plant | |
| F. Garden adornments | |
| G. Pest or disease of garden plants | |
| 5. Record + Viva-voce | 5+3 = 8 |

Course 7D: Agroforestry

(Skill Enhancement Course (Elective), Credits: 05)

I. Learning Outcomes:

Students at the successful completion of the course will be able to:

1. Understand the concepts and economic value of agroforestry.
2. Acquire a critical knowledge on systems and design of agroforestry.
3. Explain silviculture practices in relation to agroforestry.
4. Understand the role of agroforestry to reclaim the waste lands.
5. Perform skills in relation to tree measurement techniques.

II. Syllabus: (Hours: Teaching: 50, Lab: 30, Field training: 05, others incl. unit tests: 05)
(*Syllabi of theory, practical and lab (skills) training together shall be completed in 80 hours*)

Unit-1: Basic concepts of Agroforestry (10h)

1. Forest and Agroforestry. Definition, objectives, scope and advantages of agroforestry; classification of agroforestry; differences between social forestry and agroforestry.
2. Agroforestry practices as existing in India and Andhra Pradesh.
3. Criteria for selection and screening of tree species; design and diagnosis methodology in relation to agroforestry.

Unit-2: Systems of Agroforestry (10h)

1. Global agroforestry system: shifting cultivation, taungya cultivation, shelter belt and wind breaks, and energy plantation and homestead gardens.
2. Multipurpose tree species and their characteristics; criteria for selection of agroforestry design, role tree architecture and management in agroforestry.
3. Alley cropping, high density short rotation plantation systems, silvicultural woodlots, energy plantations.

Unit-3: Silviculture of Agroforestry trees (10h)

1. Silviculture: Definition, objectives and scope and its place in agroforestry.
2. Choice of species, site selection, and pure versus mixed crop, planting techniques and methods, protection of seedlings/ plantations from environmental and biological adversaries, tending operations, concept of coppice etc.
3. Silviculture of agroforestry trees with special reference to: (a) *Azadirachta indica*, (b) *Tectona grandis* (c) *Embllica officinalis* and (d) *Tamarindus indica*.

Unit-4: Waste land reclamation (10h)

1. Wasteland definition, types: ecological characteristics, landslides, soil erosion, hoods, drought, salinity, water logging and fire.
2. Biological causes of deforestation, grazing, shifting cultivation and faulty agricultural practices.

3. Reclamation of wastelands, scientific land use practices, afforestation, soil conservation practices, improvement of water catchment areas and development of recreational and amenity areas.

Unit-5: Measurements in Agroforestry (10h)

1. Tree measurement techniques: Instruments and methods for measurement of tree diameter, height, bark thickness, crown volume crown surface area.
2. Tree stem form, yield tables, volume tables, concept of sustained yield, and kind of tree rotation, increment and yield; estimation of biomass.
3. Determination of tree age and introduction of working plan.

III. References:

1. Dwivedi, A.P. 1992. Agroforestry: Principles and Practices. Oxford & IBH
2. Nair, P.K.R. 1993. An Introduction to Agroforestry. Kluwer.
3. Nair P.K.R., M.R. Rai and L.E.Buck, 2004. New Vistas in Agroforestry. Kluwer
4. Rajeshwar Rao G., M. Prabhakar, G. Venkatesh, I. Srinivas and K. Sammi Reddy (2018) Agroforestry Opportunities for Enhancing Resilience to Climate Change in Rainfed Areas, ICAR-CRIDA, Hyderabad
5. Young, A. 1997. Agroforestry for Soil Management. CABI
6. Web resources suggested by the teacher concerned and the college librarian including reading material.

Course 7D: Agroforestry – Practical syllabus

IV. Learning Outcomes: On successful completion of this practical course, student will be able to:

1. Identify suitable tree species for agroforestry and their products.
2. Demonstrate skills on raising tree species from seeds and by vegetative propagation.
3. Perform skills on measurements related to wood-based products.
4. Estimate biomass in an energy plantation.

V. Practical (Laboratory) Syllabus: (30 hrs)

1. Identification of agroforestry tree-species.
2. Identification of important major and minor agroforest products.
3. Collection and maintenance of agro-forest products and herbarium
4. Nursery lay out seed sowing and pre-sowing seed treatments.
5. Vegetative propagation techniques – hard wood cuttings and air layering.
6. Diameter measurements using calipers and tape; diameter measurements of forked, buttressed, fluted and leaning trees.
7. Height measurement of standing trees by shadow method, single pole method and hypsometer.
8. Volume measurement of logs using various formulae.
9. Biomass estimation in energy plantations.

VI. Lab References:

1. Meena, R. N. and R.K. Singh, 2014. A Practical Manual on Agroforestry, Srijan Samiti Publication, Varanasi
2. Dadhwal, K.S., P.Panwar, R.Kaushal, H.S.Saralch and R.Chauhan, 2014. Practical Manual on Agroforestry, Jaya Publishing House, Delhi

3. Sen, N. L., R. C. Dadheech, L. K. Dashora and T. S. Rawat, 2010. Manual of Agroforestry and Social forestry, Agrotech Publishing Academy, Udaipur
4. Web sources suggested by the teacher concerned.

VII. Co-Curricular Activities:

a) Mandatory: (*Lab/field training of students by teacher: (Lab: 10 + field: 05 hours)*)

1. **For Teacher:** Training of students by the teacher in the laboratory/field for not less than 15 hours on techniques like selection and screening of tree species, design and diagnosis methodology in agroforestry, silviculture practices for some selected tree species and measurements in agroforestry.
2. **For Student:** Students shall (individually) visit to nurseries of forest department, agroforestry division in Horticulture university/research station, agroforest/silviculture sites, write their observations on nursery practices, various species grown in an agroforest, growth habit, cultivation practices, measurements, products etc., and submit to the teacher a hand-written Fieldwork/Project work Report not exceeding 10 pages in the given format.
3. Max marks for Fieldwork/Project work Report: 05
4. Suggested Format for Fieldwork/Project work Report: Title page, student details, index page, details of place visited, observations, findings and acknowledgements.
5. Unit tests (IE).

a) Suggested Co-Curricular Activities:

1. Training of students by related industrial experts.
2. Assignments (including technical assignments like criteria for selection of agroforestry tree species; silviculture practices in agroforests; measurements in agroforestry; economic, social, land use and cultural services of agroforestry)
3. Seminars, Group discussions, Quiz, Debates etc. (on related topics).
4. Preparation of videos on various agroforestry methods, silviculture practices, tree measurement techniques etc.,
5. Collection of material/figures/photos related to agroforestry, writing and organizing them in a systematic way in a file.
6. Visits to social forest nurseries, energy plantations and forest research centres; nearby agro-forest based industries in A.P.
7. Invited lectures and presentations on related topics by field/industrial experts

Model Question Paper Pattern for Practical Examination

Semester – V/ Botany Skill Enhancement Course

Agroforestry

Max. Time: 3 Hrs.

Max. Marks: 50

- | | |
|--|------------|
| 1. Demonstration pre-sowing seed treatments ‘A’ | 8 |
| 2. Demonstration of hard wood cutting/air layering technique ‘B’ | 10 |
| 3. Demonstration of technique of diameter/height measurement ‘C’ | 12 |
| 4. Scientific observation and data analysis | 4 x 3 = 12 |
| D. Agroforest plant | |
| E. Agroforest product | |
| F. A tool used for measurement | |
| G. A herbarium specimen collected by him/her for identification | |
| 5. Record + Viva-voce | 5+3 = 8 |

Suggested pattern for Question Paper of Theory Examination(s) at Semester end

Max. Time: 3 Hrs.

Max. Marks: 75 M

Section – A

Answer **all** the following questions.

5 x 2 = 10 M

- ✓ One question should be given from each Unit in the syllabus.

Section – B

Answer any **Four** of the following questions. Draw a labelled diagram wherever necessary

3 x 5 = 15 M

- ✓ One question should be given from each Unit in the syllabus.

Section – C

Answer any **five** of the following questions. Draw a labelled diagram wherever necessary

5 x 10 = 50 M

- ✓ Two questions (a & b) are to be given from each Unit in the syllabus (internal choice in each unit). Student has to answer 5 questions by choosing one from a set of questions given from a Unit.

Note: Questions should be framed in such a way to test the understanding, analytical and creative skills of the students. All the questions should be given within the frame work of the syllabus prescribed.

**III B. Sc - SEMESTER- V: BOTANY PRACTICAL
PRACTICAL PAPER-VI: PLANT ECOLOGY & PHYTOGEOGRAPHY**

Total hours of teaching 30 hrs @ 3 hrs per week

1. Study of instruments used to measure microclimatic variables; soil thermometer, maximum and minimum thermometer, anemometer, psychrometer, rain gauge, and lux meter.
2. Permeability (percolation; total capacity as well as rate of movement) of different soil samples.
3. Determination of soil pH
4. Study of morphological and anatomical adaptations of hydrophytes and xerophytes (4 each)
5. Determination of minimal quadrat size for the study of herbaceous vegetation in the college campus by species area curve method
6. Study of Phytoplankton and macrophytes from water bodies.
6. Study of species diversity index of vegetation.
7. Estimation of Primary Productivity of an ecosystem
8. To study field vegetation with respect to stratification, canopy cover and composition.
9. Study of plants included in agro forestry and social forestry.
10. To locate the hotspots, phyto geographical regions and distribution of endemic plants in the map of India.
1. The following practical should be conducted in the Field/lab with the help of photographs, herbarium, Floras, Red data book- Study of endangered plants species, critically endangered plants species, vulnerable plant species and monotypic endemic genera of India.

**III B. Sc - SEMESTER- VI: BOTANY PRACTICAL MODEL PAPER
PAPER-VI: PLANT ECOLOGY & PHYTOGEOGRAPHY**

1. Study Project under supervision	= 15 Marks
2. Record & Viva-Voce	= 10 Marks
3. Experiment A	= 10 Marks
4. Anatomical adaptations of B (Section cutting)	= 10 Marks
5. Spotters C&D (2x2 1/2)	= 5 Marks

	Total = 50 Marks

1. Study Project of a surrounding Ecosystem (terrestrial or aquatic)(plant diversity, animal diversity, human activity, pollution levels, restoration efforts under supervision.

2. Presentation of the project work in Q & A session.
3. **A** -determination of soil porosity/PH/percolation/retaining capacity.
4. **B**- Xerophyte/Hydrophyte anatomical adaptations.
5. **C & D**-anemometer/rain gauze/lux meter.

SEMESTER-VI: Electives

Andhra Pradesh State Council of Higher Education
w.e.f. 2015-16 (Revised in April 2016)

III B. Sc - BOTANY SYLLABUS SEMESTER- VI

PAPER – VII – ELECTIVE [(A) or (B) or (C)]

Paper VII-(A): ORGANIC FARMING & SUSTAINABLE AGRICULTURE

Total hours of teaching 60hrs @ 3hrs per week

Unit - I: Concept of organic farming: (12hrs)

1. Introduction: Farming, organic farming, concept and development of organic farming.
2. Principles of organic farming, types of organic farming, biodynamic farming.
3. Benefits of organic farming, need for organic farming, conventional farming v/sorganic farming
4. Scope of organic farming; Andhra Pradesh, National and International status.
5. Agencies and institutions related to organic agriculture.
6. Requirements for organic farming, farm components for an organic farm.

Unit - II: Organic plant nutrient management: (12hrs)

1. Organic farming systems, soil tillage, land preparation and mulching.
2. Choice of varieties.
3. Propagation-seed, planting materials and seed treatments, water management
4. Green manuring, composting- principles, stages, types and factors, composting methods, Vermi composting
5. Bulky organic manures, concentrated organic manures, organic preparations, organic amendments and sludges.
6. Bio-fertilizers- types, methods of application, advantages and disadvantages, standards for organic inputs- fertilizers

Unit-III: Organic plant protection: (12hrs)

1. Plant protection- cultural, mechanical, botanical pesticides, control agents
2. Weed management
3. Standards for organic inputs- plant protection.

Unit- IV: Organic crop production practices: (12hrs)

1. Organic crop production methods- rice, coconut.
2. Organic crop production methods- vegetables- okra, amaranthus, cucurbits.
3. Livestock component in organic farming.
4. Sustainable Agriculture-Apiculture, Mushroom cultivation.

Unit- V: Organic Certification (12hrs)

1. Farm economy: Basic concept of economics- demand &supply, economic viability of a farm.
2. Basic production principles, reducing expenses, ways to increase returns, cost of production system. Benefit/ cost ratio, marketing, imports and exports.

3. Policies and incentives of organic production.
4. Farm inspection and certification.
5. Terrace farming.

Books for Reference:

1. Palaniappan SP & Anandurai K. 1999. Organic Farming—Theory and Practice. Scientific Publishers, Jodhpur
2. Joshi, M. 2014. New Vistas of Organic Farming 2nd Ed. Scientific Publishers, Jodhpur.
3. Farming system : Theory and Practice - S.A.Solaimalai
4. Organic Farming: Theory and Practice- S.P.Palaniappan and K.A. Annadurai
5. A hand book of Organic Farming by A.K.Sharma

Suggested Activities: Preparation of Vermicompost in small scale, observing sewage sludge disposal mechanisms in urban/semi urban areas, studying the usage, of green manures, neem oil, neem cake, pongamia oil in organic farming, livestock component in various farming methods, visiting an Apiculture center, drawing various terrace farming models

Paper-VII-A : Practical
Semester – VI, Paper-VII-A : Organic Farming and Sustainable Agriculture
Total hours of teaching 30 hrs @ 2 hrs per week

1. Study of different bio pesticides, weedicides, inorganic and organic fertilizers
2. Deficiency symptoms of nutrient deficiency symptoms (photographs)
3. Soil testing, liming, and fertilizing
4. Preparation of enriched Farm Yard Manure.
5. Study of composting methods.
6. Preparation of vermicompost.
7. Study of recycling of farm waste.
8. Study of methods of green manuring.
9. Study of steps in mushroom cultivation
10. Visit to urban waste recycling unit.
11. Study project report under supervision of lecturer – farm manure preparation/vermicompost// waste management// green manures/ mushroom cultivation / nutrient requirements of vegetables

Expected domain skills to be achieved: Performing Soil analysis, soil enrichment methods, composting procedure, recycling of wastes, use of waste materials in mushroom cultivation, understanding nutrient requirement of various crops, identifying various methods of keeping soil health

PRACTICAL MODEL PAPER

Paper-VII-(A) : Organic Farming and Sustainable Agriculture

Q1. Project report (A)	- 15 marks
Viva-voce on study project	-05 marks
Q2. Identify and write notes on B, C, D, and E (4x5)	-20 marks
B- inorganic manures/bio-weedicides/bio-pesticides (photograph/ specimen)	
C- Compost preparation method (photograph/instrument)	
D- Green manure type (plant specimen/photograph)	
E- Waste recycling method (photograph/live specimen/institute/organization)	
Q4. Field report	- 05 marks
Q5. Record	- 05 marks
TOTAL:	50 marks

Unit I: Nursery: (12 hrs.)

1. Definition, objectives, scope and building up of infrastructure for nursery.
2. Planning and seasonal activities - Planting - direct seeding and transplants.
3. Nursery Management and Routine Garden Operations.

Unit III: Gardening (12 hrs.)

1. Definition, objectives and scope - different types of gardening.
2. Landscape and home gardening - parks and its components, plant materials and design .
3. Computer applications in landscaping.
4. Gardening operations: soil laying, manuring, watering.
5. Landscaping Places of Public Importance: Landscaping highways and Educational Institutions)
6. Some Famous gardens of India.

Unit III: Propagation methods (12 hrs.)

- 1 Sowing/raising of seeds and seedlings, transplanting of seedlings.
2. Air-layering, cutting, selection of cutting ,propagule collecting season, treatment of cutting rooting medium and planting of cuttings - Hardening of plants.
3. Propagation of ornamental plants by rhizomes, corms tubers, bulbs and bulbils.
4. Green house - mist chamber, shed root, shade house and glass house for propagation.

Unit IV: Floriculture: (12 hrs.)

1. Ornamental Plants: Flowering annuals; herbaceous, perennials; Divine vines; Shade and ornamental trees.
2. Ornamental bulbous and foliage plants; Cacti and succulents.
3. Ornamentals-palms.
4. Cultivation of plants in pots; Indoor gardening; Bonsai.

Unit V: Commercial Floriculture

(12 hrs.)

1. Factors affecting flower production; Production and packaging of cut flowers; Flower arrangements; Methods to prolong vase life of flowers
2. Cultivation of Important cut flowers (Carnation, Aster, Dahlia, Gerbera, Anthuriums, Gladiolous, Marigold, Rose, Lilium)
3. Management of pests, diseases and harvesting.
4. Methods of harvesting.

Books for Reference:

1. Bose T.K. & Mukherjee, D., 1972, Gardening in India, Oxford & IBH Publishing Co., New Delhi.
2. Sandhu, M.K., 1989, Plant Propagation, Wile Eastern Ltd., Bangalore, Madras.
3. Kumar, N., 1997, Introduction to Horticulture, Rajalakshmi Publications, Nagercoil. institution)
4. Randhawa, G.S. and Mukhopadhyay, A. 1986. Floriculture in India. Allied Publishers.

Suggested Activities: Raising a nursery, managing it, studying and drawing various land scaping designs, practicing layering methods, using shade nets to protect horticultural crops, practicing indoor gardening techniques, visiting florists and recording their methods of prolonging vase life of commercial cut flowers.

III B. Sc - BOTANY SYLLABUS SEMESTER- VI (Elective) Practical Syllabus, Paper VII-(B): Nursery, Gardening and Floriculture Total hours of teaching 30hrs @ 2hrs per week

1. Tools, implements and containers used for propagation and nursery techniques.
2. Propagation by cutting, layering, budding and grafting
3. Seed propagation- preparation of portable trays, seed treatments, sowing and seedling production.
4. Identification and description of annuals, herbaceous perennials, climbers, creepers, foliage and flowering shrubs, trees, palms, ferns, ornamental grasses; cacti and succulents..
5. Planning and designing of gardens, functional uses of plants in the landscape
6. Preparation of land for lawn and planting.
7. Identification of commercially important flower crops and their varieties.
8. Propagation practices in flower crops, sowing of seeds and raising of seedlings of annuals.
9. Use of chemicals and other compounds for prolonging the vase life of cut flowers.
10. Grading, packing and marketing of cut flowers.
11. Visit to commercial nurseries and commercial tissue culture laboratory
12. Study project under supervision of lecturer – nursery/ornamental flowers/ plants/lawn designing/ landscape designing

Expected domain skills to be achieved: Ability to use a variety of garden tools and implements, proficiency in layering and grafting techniques (cleft grafting and bud grafting), land scape drawings using computers, raising of healthy nurseries of flowering plants, managing vase life of cut flowers etc.

PRACTICAL MODEL PAPER

Paper-VII-(B): Nursery, Gardening and Floriculture

Q1. Project report (A)	- 15 marks
Viva-voce on study project	-05 marks
Q2. Identify and write notes on B, C, D, and E (4x5)	-20 marks
B- Tool/instrument/container used in nursery	
C-Seed propagation technique	
D- Plant used in lawn (plant specimen/photograph)	
E-ornamental flower (photograph/live specimen)	
Q4. Field report	- 05 marks
Q5. Record	- 05 marks
	50 marks

III B. Sc - BOTANY SYLLABUS SEMESTER- VI

PAPER – VII – ELECTIVE

Paper VII-(C): Plant tissue culture and its biotechnological applications

Total hours of teaching 60hrs @ 3hrs per week

Unit I: PLANT TISSUE CULTURE – 1

(12hrs)

1. History of plant tissue culture research - basic principles of plant tissue callus culture, meristem culture, organ culture, Totipotency of cells, differentiation and dedifferentiation.
2. Methodology - sterilization (physical and chemical methods), culture media, Murashige and Skoog's (MS medium), phytohormones, medium for micro-propagation/clonal propagation of ornamental and horticulturally important plants.
3. Callus subculture maintenance, growth measurements, morphogenesis in callus culture – organogenesis, somatic embryogenesis.

UNIT-II: Plant Tissue culture -2

(12hrs)

1. Endosperm culture – Embryo culture -culture requirements – applications, embryo rescue technique.
2. Production of secondary metabolites.
3. Cryopreservation; Germ plasm conservation.

Unit III: Recombinant DNA technology

(12hrs)

1. Restriction Endonucleases (history, types I-IV, biological role and application); concepts of restriction mapping.
2. Cloning Vectors: Prokaryotic(pUC 18, pBR322,Ti plasmid and Lambda phage, Eukaryotic Vectors (YAC and briefly PAC)
3. Gene cloning (Bacterial Transformation and selection of recombinant clones, PCR mediated gene cloning)
4. Construction of genomic and cDNA libraries, screening DNA libraries to obtain gene of interest by complementation technique, colony hybridization.

Unit IV: Methods of gene transfer

(12hrs)

1. Methods of gene transfer- Agrobacterium-mediated, direct gene transfer by Electroporation, Microinjection, Micro projectile bombardment.
2. Selection of transgenics– selectable marker and reporter genes (Luciferase, GUS, GFP).

Unit V: Applications of Biotechnology

(12 hrs)

1. Applications of Plant Genetic Engineering – crop improvement, herbicide resistance, insect resistance, virus resistance.
2. Genetic modification – transgenic plants for pest resistant (Bt-cotton); herbicide resistance (Round Up Ready soybean); improved agronomic traits - flavrSavr tomato, Golden rice); Improved horticultural varieties (Moon dust carnations)

Books for Reference:

1. Pullaiah. T. and M.V.Subba Rao. 2009. Plant Tissue culture. Scientific Publishers, New Delhi.
2. Bhojwani, S.S. and Razdan, M.K., (1996). Plant Tissue Culture: Theory and Practice. Elsevier Science Amsterdam. The Netherlands.
3. Glick, B.R., Pasternak, J.J. (2003). Molecular Biotechnology- Principles and Applications of recombinant DNA. ASM Press, Washington.
4. Bhojwani, S.S. and Bhatnagar, S.P. (2011). The Embryology of Angiosperms. Vikas Publication House Pvt. Ltd., New Delhi. 5th edition.
5. Snustad, D.P. and Simmons, M.J. (2010). Principles of Genetics. John Wiley and Sons, U.K. 5th edition.
6. Stewart, C.N. Jr. (2008). Plant Biotechnology & Genetics: Principles, Techniques and Applications. John Wiley & Sons Inc. U.S.A.

Suggested Activities: In vitro initiation of callus on artificial medium, seminars on utilization of rDNA technology, debates on applications of Biotechnology (whether it is a boon or bane to the society) studying growth patterns, vegetative characteristics of Bt.cotton and identifying the features of its pest resistance

III B. Sc - BOTANY SYLLABUS SEMESTER- VI
PAPER – VII-(C) Elective
Practical Paper VII-(C): Plant Tissue Culture & Plant Biotechnology
Total hours of teaching 30hrs @ 2hrs per week

1. (a) Preparation of MS medium.
(b) Demonstration of in vitro sterilization methods and inoculation methods using leaf and nodal explants of Tobacco/ Datura/ Brassica etc.
2. Study of embryo and culture, micro propagation of Banana, somatic embryogenesis, artificial seeds through photographs.
3. Construction of restriction map of circular and linear DNA from the data provided.
4. Study of methods of gene transfer through photographs: Agrobacterium-mediated, direct gene transfer by electroporation, microinjection, and micro projectile bombardment.
5. Different steps involved in genetic engineering for production of Bt. cotton, Golden rice, Flavr Savr tomato through photographs.
7. Isolation of plasmid DNA.
8. Restriction digestion and gel electrophoresis of plasmid DNA (optional)
9. Field visit to a lab involved in tissue culture
10. Study project under supervision of lecturer – tissue culture/ genetic engineering

Expected domain skills to be achieved: Ability to prepare artificial nutrient media, preparing independently, applying various sterilization procedures for media, glassware and biological materials, in vitro propagation of Banana callus, morphogenesis--s, clonal propagation methods, isolation of plasmid DNA individually and as a group.

PRACTICAL MODEL PAPER

Paper-VII-(C) : Plant Tissue Culture & Plant Biotechnology

Q1. Project report (A)	- 15 marks
Viva-voce on study project	-05 marks
Q2. Identify and write notes on B, C and D (3x4)	-12 marks
B- Tool/instrument/container used in sterilization	
C- Tool/instrument/container used in gene transfer	
D- GM crops (Photographs)	
Q3. Construct restriction map of circular and/ or linear DNA from the data provided –	08 marks
Q4. Field report	- 05 marks
Q5. Record	- 05 marks

	50 marks

CLUSTER ELECTIVES (Cluster-A or Cluster-B)
III B.Sc.: BOTANY SYLLABUS SEMESTER- VI
Paper VIII, CLUSTER ELECTIVE, Cluster-A,
Paper VIII-A-1 : PLANT DIVERSITY AND HUMAN WELFARE
Total hours of teaching 60hrs @ 3hrs per week

Unit- I: Plant diversity and its scope: (12hrs)

- i. Genetic diversity, Species diversity, Plant diversity at the ecosystem level, Agro biodiversity and cultivated plant taxa, wild taxa.
- ii. Values and uses of biodiversity: Ethical and aesthetic values,
- iii. Methodologies for valuation, Uses of plants.

Unit -II: Loss of biodiversity: (12hrs)

- i. Loss of genetic diversity, Loss of species diversity, Loss of ecosystem diversity, Loss of agro biodiversity, projected scenario for biodiversity loss
- ii. Management of plant biodiversity: Organizations associated with biodiversity management-Methodology for execution-IUCN, UNEP, UNESCO, WWF, NBPGR; Biodiversity legislation and conservations, Biodiversity information management and communication.

Unit-III: Contemporary practices in resource management: (12hrs)

- i. Environmental Impact Assessment (EIA), Geographical Information System GIS, Participatory resource appraisal, Ecological footprint with emphasis on carbon footprint, Resource accounting;
- ii. Solid and liquid waste management

Unit -IV: Conservation of biodiversity (12hrs)

- i. Conservation of genetic diversity, species diversity and ecosystem diversity, *In situ* and *ex situ* conservation,
- ii. Social approaches to conservation, Biodiversity awareness programmes, Sustainable development.

Unit- V: Role of plants in relation to Human Welfare (12hrs)

- i. Importance of forestry, their utilization and commercial aspects-
 - a) Avenue trees, b) ornamental plants of India. c) Alcoholic beverages through ages.
- ii. Fruits and nuts: Important fruit crops their commercial importance. Wood, fiber and their uses.

Suggested Readings:

1. Krishnamurthy, K.V. (2004). An Advanced Text Book of Biodiversity - Principles and Practices. Oxford and IBH Publications Co. Pvt. Ltd. New Delhi.
2. Singh, J. S., Singh, S.P. and Gupta, S. (2006). Ecology, Environment and Resource Conservation. Anamaya Publications, New Delhi.
3. Rogers, P.P., Jalal, K.F. and Boyd, J.A. (2008). An Introduction to Sustainable Development. Prentice Hall of India Private Limited, New Delhi.

Suggested activities: Study of flora and its diversity in the college campus or local area, enumerating wild and exotic species (*Parthenium*, Water hyacinth etc.)

Project work on any one of the International organizations striving for preservation of biodiversity, study of conservation efforts of local people, and civic bodies, study of locally available fruits in different seasons, enumerating the avenue plantations and their diversity in your town/city

Paper – VIII-A-1 : Practicals: PLANT DIVERSITY AND HUMAN WELFARE

- 1) Study of plant diversity (flowering plants).
- 2) Study of exotic species- Identification and morphological characteristics.
- 3) Identification of forest trees through bark, wood, flowers, leaves and fruits.
- 4) Maceration, Study of wood (Tracheary elements, fibres).
- 5) Methods of preservation and canning of fruits.
- 6) Visit to the local ecosystem to study the plants.
- 7) Write up on the conservation efforts of International organizations.
- 8) Study of Solid and Liquid waste management systems in rural/urban areas.

Domain skills expected to achieve: Identification of exotic plant species, identification of forest trees based on the characteristics of bark, flowers and fruits, understanding the preservation methods of fresh and dry fruits, understanding the methods of safe disposal of biodegradable and non-biodegradable wastes

SCHEME OF PRACTICAL EXAMINATION

PRACTICAL- VIII-A-1 : Cluster Elective (MODEL QUESTION PAPER)
PLANT DIVERSITY AND HUMAN WELFARE

Time: 3hrs

Max. Marks: 50

- I. Assign the plants **A, B and C** to their respective families, giving reasons, family name and classification-2 marks, important diagrams- 3 marks. **15 marks**
- II. Give the protocol of **D** **10 marks**
- III. Comment on specimens **E, F and G** **3x3 = 9 marks**
- IV. Report on Field visit **6 marks**
To study sources of firewood (10 plants), timber-yielding trees (10trees) and bamboos.
- V. Viva-Voce **5 marks**
- VI. Practical Record **5 marks**

KEY

A-Cultivated Plant

B- Wild Plant

C –Exotic plant

D- Preservation and canning of fruits, solid and liquid waste management systems in rural/urban areas

E. Bark/wood/fruit yielding plant

F. Nuts/ Alcoholic beverage plant

G. wood /Fibre yielding plant

III B. Sc - BOTANY SYLLABUS

SEMESTER- VIII : CLUSTER ELECTIVE -A

Paper VIII-A-2 : ETHNOBOTANY AND MEDICINAL BOTANY

Total hours of teaching 60hrs @ 3hrs per week

Unit –I: Ethnobotany (12hrs)

- i. Introduction, concept, scope and objectives; Ethnobotany as an interdisciplinary science. The relevance of ethnobotany in the present context
- ii. Major and minor ethnic groups or Tribals of India, and their life styles.
- iii. Plants used by the tribal populations: a) Food plants, b) intoxicants and beverages, c) Resins and oils and miscellaneous uses.

Unit -II: Role of ethnobotany in modern Medicine: (12hrs)

- i. Role of ethnobotany in modern medicine with special example *Rauvolfia serpentina*, *Trichopus zeylanicus*, *Artemisia annua*, *Withania somnifera*.
- ii. Medico-ethnobotanical sources in India
- iii. Significance of the following plants in ethno botanical practices (along with their habitat and morphology)
 - a) *Azadirachta indica*, b) *Ocimum sanctum*, c) *Vitex negundo*, d) *Gloriosa superba*, e) *Tribulus terrestris*, f) *Phyllanthus niruri*, g) *Cassia auriculata*, h) *Indigofera tinctoria*, i) *Senna auriculata* j). *Curcuma longa*.
- iv. Role of ethnic groups in the conservation of plant genetic resources.

Unit-III: Ethnobotany as a tool to protect interests of ethnic groups (12hrs)

- i. Sharing of wealth concept with few examples from India.
- ii. Biopiracy, Intellectual Property Rights and Traditional Knowledge.

Unit -IV: History, Scope and Importance of Medicinal Plants. indigenous Medicinal Sciences (12hrs)

- i. Definition and Scope-**Ayurveda**: History, origin, panchamahabhutas, saptadhatu and tridosha concepts, Rasayana, plants used in ayurvedic treatments.
- ii. **Siddha**: Origin of Siddha medicinal systems, Basis of Siddha system, plants used in Siddha medicine.
- iii. **Unani**: History, concept: Umoor-e- tabiya, tumors treatments/ therapy, polyherbal formulations (in brief).

Unit -V: Conservation of endangered and endemic medicinal plants:

(12hrs)

- i. Definition: endemic and endangered medicinal plants,
- ii. Red list criteria
- iii. *In situ* conservation: Biosphere reserves, sacred groves, National Parks
- iv. *Ex situ* conservation: Botanical Gardens.

Suggested Activities: Studying plant utilization methods by tribal/rural/migrant populations for their beverages, food, medicinal and uses, seminars on role of ethnic groups in conservation of plant genetic resources, project work on traditional knowledge about plant medicines, study of indigenous medicinal sciences and their efficacy.

Suggested Readings:

- 1) S.K. Jain, Manual of Ethnobotany, Scientific Publishers, Jodhpur, 1995.
- 2) Glimpses of Indian. Ethnobotny, Oxford and I B H, New Delhi – 1981.
- 3) S.K. Jain (ed.) 1989. Methods and approaches in ethnobotany. Society of ethnobotanists, Lucknow, India.
- 4) S.K. Jain, 1990. Contributions of Indian ethnobotny. Scientific publishers, Jodhpur.
- 5) Colton C.M. 1997. Ethnobotany – Principles and applications. John Wiley and sons – Chichester
- 6) Rama Ro, N and A.N. Henry (1996). The Ethnobotany of Eastern Ghats in Andhra Pradesh, India. Botanical Survey of India. Howrah.
7. Trivedi P C, 2006. Medicinal Plants: Ethnobotanical Approach, Agrobios, India.
8. Purohit and Vyas, 2008. Medicinal Plant Cultivation: A Scientific Approach, 2nd edn. Agrobios, India.
9. Pal, D.C. & Jain, S.K., 1998. Tribal Medicine. Naya Prakash Publishers, Calcutta
10. Raychudhuri, S.P., 1991. (Ed.) Recent advances in Medicinal aromatic and spice crops. Vol.1, Today & Tomorrow's printers and publishers, New Delhi

Cluster Elective VIII-A-2: Practical:

ETHNOBOTANY AND MEDICINAL BOTANY

1. Ethnobotanical specimens as prescribed in theory syllabus
2. Detailed morphological and anatomical study of medicinally important part(s) of locally available plants (Minimum 8 plants) used in traditional medicine.
3. Field visits to identify and collect ethno medicinal plants used by local tribes/folklore.

Domain skills expected to achieve: Identification of various plant parts used as medicines by ethnic groups, understanding the difference between ancient wisdom and modern system of medicine, traditional medicine at the rescue of curing drug resistant maladies like malaria and viral diseases, understanding the role of spices in Indian kitchens, their therapeutic role

PRACTICAL- VIII-A-2 Cluster Elective : MODEL QUESTION PAPER

Paper VIII-A-2: ETHNOBOTANY AND MEDICINAL BOTANY

Time: 3 Hours

Max. Marks- 50

I. Identify the specimen A- Give reasons (morphological and anatomical) and draw labeled sketches 15marks

II. Identify and write about the medicinal uses of B-and C- 2x5= 10 marks.

III. Comment on D and E. 2x 4=8 marks

IV. Report on Field visit: 7 marks

List to be prepared mentioning special features of plants used by tribal populations as Medicinal Plants & Spices. Write their botanical and common names, parts used and diseases/disorders for which they are prescribed.

V. Viva-voce 5 marks

VI. Record 5 marks

- -----
Total = 50 marks

KEY

A-Plants given in unit II (i)

B-Plants used in Ayurvedic preparations (Amla in Chyavanprash, Senna in Laxatives)

C - - Do -

D. Photographs of National parks, Biosphere reserves and Botanical gardens.

E. Photograph of famous personalities in Ayurveda/Siddha medicine.

**III B. Sc - BOTANY SYLLABUS SEMESTER- VIII
CLUSTER ELECTIVE, Paper VIII-A-3**

Paper VIII-A-3: Pharmacognosy and Phytochemistry

Unit-I: Pharmacognosy (12hrs)

Definition, Importance, Classification of drugs - Chemical and Pharmacological, Drug evaluation methods

Unit –II: Organoleptic and microscopic studies: (12hrs)

Organoleptic and microscopic studies with reference to nature of active principles and common adulterants of *Alstonia scholaris* (bark), *Adhatoda vasica*(leaf), *Strychnos nuxvomica* (seed), *Rauwolfia serpentina*(root) and *Zinziber officinalis Catharanthus roseus*.

Unit-III: Secondary Metabolites: (12hrs)

- i. Definition of primary and secondary metabolites and their differences, major types - terpenes, phenolics, alkaloids, terpenoids, steroids.
- ii. A brief idea about extraction of alkaloids. Origin of secondary metabolites – detailed account of acetate pathway, mevalonate pathway, shikimate pathway.

UNIT-IV: Phytochemistry: (12hrs)

Biosynthesis and sources of drugs:

- (i) Phenols and phenolic glycosides : structural types, biosynthesis, importance of simple phenolic compounds, tannins, anthraquinones, coumarins and furanocoumarins, flavones and related flavonoid glycosides, anthocyanins, betacyanins, stilbenes, lignins and lignans).
- (ii) Steroids, sterols, saponins, withanolides, ecdysones, cucurbitacins: Biosynthesis, commercial importance.
- (iii) Alkaloids: Different groups, biosynthesis, bioactivity.
- (v) Volatile oils, aromatherapy.

UNIT-V: Enzymes, proteins and amino acids as drugs: (12hrs)

- i. Vaccines, toxins and toxoids, antitoxins, immune globulins, antiserums,
- ii. Vitamins, Antibiotics – chemical nature, mode of action.
- iii. Pharmacological action of plant drugs – tumor inhibitors, PAF antagonists, antioxidants, phytoestrogens and others.
- iv. Role of different enzyme inhibitors.

Suggested Activities: Isolation techniques of active principles from various parts of popular medicinal plants, debates on the efficacy of plant medicines and palliative cure, volatile oils from plants-extraction methods, project work on crude drugs

BOOKS FOR REFERENCE:

1. Wallis, T. E. 1946. Text book of Pharmacognosy, J & A Churchill Ltd. 2.
Roseline, A. 2011. Pharmacognosy. MJP Publishers, Chennai.
2. Gurdeep Chatwal, 1980. Organic chemistry of natural productis.
Vol.I.Himalaya Publishing house.
3. Kalsi, P. S. and Jagtap, S., 2012. Pharmaceutical medicinal and natural product chemistry N.K. Mehra . Narosa Publishing House Pvt. Ltd. New Delhi.
4. Agarwal, O. P. 2002. Organic chemistry–Chemistry of organic natural products. Vol. II. Goel publishing house , Meerut.
5. Harborne, J. B. 1998. Phytochemical methods –a guide to modern techniques of plant analysis 3 rd edition, Chapman and Hall
6. Datta & Mukerji, 1952. Pharmacognosy of Indian roots of Rhizome drugs.
Bulletin No.1 Ministry of Health, Govt. of India.

VIII-A-3: Pharmacognosy and Phytochemistry: PRACTICALS

1. Physical and chemical tests for evaluation of unorganized drugs-
Asaphoetida. Honey,
Castor oil. Acacia
2. Identification of bark drugs – cinchona, cinnamom
3. Identification of fruit drugs – Cardamom, Coriander
4. Identification of root and rhizome drugs- Ginger, Garlic, Turmeric
5. Identification of whole plant – Aloes, Vinca, Punarnava

6. Herbarium of medicinal plants (minimum of 20 plants)
7. Collection of locally available crude drugs from local vendors (minimum of 20)

Domain skills expected to achieve: Identification of various plant parts used as medicines, extraction of active principles from them, isolation by chromatographic techniques, learning callus culture techniques for secondary metabolite enrichment and understanding ethno-pharmacological principles

**PRACTICAL: VIII-A-3 Cluster Elective: MODEL QUESTION PAPER
Pharmacognosy and Phytochemistry**

Time: 3hrs.

Max. Marks=50

- | | |
|--|----------------------------|
| I. Identify the given crude drugs A& B by morphological study and chemical tests. | 10 marks |
| II. Perform suitable chemical test and identify the given phytochemical C | 10 marks |
| III. Comment on D and E | 2x5=10 marks |
| IV. Herbarium and submission of drugs | -10 marks |
| IV. Viva-Voce | 5 marks |
| V. Practical Record | 5 marks |
| Total | -----
= 50 marks |

KEY

A-Flower/fruit drugs

B-Rhizome/whole plant drugs

C- Tannins/ phenolics/steroids/ isoprenoids /Asaphoetida/ Honey/ Castor oil/ Acacia

D. Column Chromatography/ Gas Chromatogram/HPLC (photograph/ instrument used for chemical analysis of drugs)

E. photograph/instrument used for tissue culture

Andhra Pradesh State Council of Higher Education

III B.Sc.: BOTANY SYLLABUS SEMESTER- VI

Cluster Electives, CLUSTER-B

CLUSTER ELECTIVE, PAPER-VIII-B-1

Paper VIII-B-1: Biological instrumentation and Methodology

Total hours of teaching 60hrs @ 3hrs per week

Unit -I: Imaging and related techniques:**(12hrs)**

Principles of microscopy; Light microscopy; Fluorescence microscopy; Electron Microscopy (a) Flow cytometry (b) Applications of fluorescence microscopy: Chromosome banding, FISH, chromosome painting; Transmission and Scanning electron microscopy – sample preparation for electron microscopy, cryofixation, negative staining, shadow casting, freeze fracture, freeze etching.

Unit- II: pH and Centrifugation:**(12 hrs)**

pH meter: Principles and instrumentation, Centrifugation: Principles, types of centrifuges, types of rotors, differential and density gradient centrifugation, application. Sonication, Freeze drying.

Unit- III: Spectrophotometry:**(12hrs)**

Principle involved in Spectrophotometer; Spectrophotometric techniques, Instrumentation: ultraviolet and visible spectrophotometry (single and double beam, double wavelength spectrophotometers), Infrared spectrometers - Luminometry and densitometry – principles and their applications - Mass Spectroscopy- principles of analysis, application in Biology.

Unit- IV: Chromatography:**(12hrs)**

Chromatographic techniques: Principle and applications – Column - thin layer –paper, affinity and gas chromatography - Gel filtration - Ion exchange and High performance liquid chromatography techniques– Examples of application for each chromatographic system - Basic principles of electrophoresis.

Unit-V: Preparation of molar, molal and normal solutions, buffers, the art of scientific writing**(12hrs)**

Understanding the details on the label of reagent bottles. Molarity and normality of common acids and bases. Preparation of solutions. Dilutions. Percentage solutions. Molar, molal and normal solutions. Technique of handling micropipettes; Knowledge about common toxic chemicals and safety measures in their handling.

The art of scientific writing and presentation of scientific matter. Scientific writing and ethics. Writing references. Powerpoint presentation. Poster presentation. Introduction to copyright-academic misconduct/plagiarism in scientific writing.

Suggested Readings:

1. Bajpai, P.K. 2006. Biological Instrumentation and methodology. S. Chand & Co. Ltd.
2. K. Wilson and J. Walker Eds. 2005. Biochemistry and Molecular Biology. Cambridge University Press.
3. K. Wilson and KH Goulding. 1986. Principles and techniques of Practical Biochemistry. (3 edn) Edward Arnold, London.
4. Dawson, C. (2002). Practical research methods. UBS Publishers, New Delhi.
5. Stapleton, P., Yondewei, A., Mukanyange, J., Houten, H. (1995). Scientific writing for agricultural research scientists – a training reference manual. West Africa Rice Development Association, Hong Kong.
6. Ruzin, S.E. (1999). Plant micro technique and microscopy. Oxford University Press, New York, U.S.A.

Suggested activities: Preparing various laboratory reagents, operating laboratory instruments, noting instrument readings, calculating results accurately, Skills on writing scientific articles, presentation of scientific results through tables, graphs, poster presentations and practicing power point presentations.

Paper VIII-B-1: PRACTICAL SYLLABUS

1. Microscopy – Light microscopy: principles, parts & function
2. Micrometry- principle and measurement of microscopic objects: Low power and high power.
3. Camera Lucida drawing with magnification and scale.
4. Principle and working of phase contrast microscope
5. Principle & operation of Centrifuge
6. Preparation of standard acid and alkali and their standardization.
b) Preparation of various solutions (normal, molar, and percent) and ppm/ppb by serial dilutions
7. Study of principle and working of pH meter and Measurement of pH of Milk, Pepsi, Lemon juice etc. using pH paper and pH meter
8. Study of principle of Chromatography and separation of amino acids mixture
By ascending Paper Chromatography
7. Principle & operation of Colorimeter
8. Principle & operation of Spectrophotometer
9. Chromosome banding, FISH, chromosome painting
9. Principle and technique of TLC (demonstration)
10. TLC separation of Amino acids from purified samples and biological materials (demonstration)
- 11 PCR - The Polymerase Chain Reaction (protocol) -demonstration
13. Study visit to an institute /laboratory

Domain skills expected to achieve:

Skill in operating laboratory equipment, their upkeep, and adept at various biological techniques. Ability to prepare molar, molal, normal solutions and solutions of different dilutions. Interpreting

scientific results, and ability to present results in a scientific way through graphs, photographs, poster presentations and power point presentations.

Paper VIII-B-1: Theory: Biological instrumentation and Methodology
PRACTICAL MODEL PAPER

- | | |
|---|---------------|
| 1. Perform the experiment (A). Write the protocol of the experiment - | 15 marks |
| 2. Measure the pH of given sample (B) using pH paper and pH meter. Write the procedure and observation. | 10 marks |
| 3. Identify C, D, and E. Write the principle and use of them. | 3X5 -15 marks |
| 4. Viva voce on Field visit | 05 marks |
| 5. Record | 05 marks |

Key

- A. Amino acid separation by paper chromatography
 - B. Milk, Pepsi, Lemon juice etc
 - C. Camera Lucida/ Micrometer/phase contrast microscope
 - D. Colorimeter/ Spectrophotometer
 - E. Chromosome banding, FISH, chromosome painting
-
-

(Cluster Electives –B)

III B.Sc.: BOTANY SYLLABUS SEMESTER- VI, CLUSTER ELECTIVE -2-B

PAPER – VIII-B-2

Paper VIII-B-2: Mushroom Culture and Technology

Total hours of teaching 60hrs @ 3hrs per week

Unit I: Introduction, history: (12hrs)

Introduction - history - scope of edible mushroom cultivation, Types of edible mushrooms available in India –*Volvariellavolvacea*, *Pleurotuscitrinopileatus*, *Agaricusbisporus*. Nutritional and medicinal value of edible mushrooms; Poisonous mushrooms.

UNIT II: Pure culture-spawn preparation: (12hrs)

Pure culture - preparation of medium (PDA and Oatmeal agar medium)sterilization - preparation of test tube slants to store mother culture – culturingof*Pleurotus* mycelium on Petriplates, preparation of mother spawn in salinebottle and polypropylene bag and their multiplication.

Unit III: Cultivation Technology: (12hrs)

Infrastructure: Substrates (locally available) Polythene bags, vessels, Inoculation hook, inoculation loop, low cost stove, sieves, culture rack, mushroom unit (Thatched house) water sprayer, tray, small polythene bag. Mushroom bed preparation - paddy straw, sugarcane trash, maize straw, banana leaves. Factors affecting the mushroom bed preparation - Low cost technology, composting technology in mushroom production.

Unit IV: Storage and nutrition : (12hrs)

Short-term storage (Refrigeration - up to 24 hours) Long term Storage (canning, pickels, papads), drying, storage in saltsolutions. Nutrition - Proteins - amino acids, mineral elements nutrition - Carbohydrates, Crude fibre content – Vitamins.

Unit V: Food Preparation: (12hrs)

Types of foods prepared from mushrooms; soup, cutlet, omelette, samosa, pickles and curry .Research Centres - National level and Regional level. Cost benefit ratio - Marketing in India and abroad, Export Value.

Suggested Readings:

1. Marimuthu, T. Krishnamoorthy, A.S. Sivaprakasam, K. and Jayarajan. R (1991) Oyster Mushrooms, Department of Plant Pathology, Tamil Nadu Agricultural University, Coimbatore.
2. Swaminathan, M. (1990) Food and Nutrition. Bappco, The Bangalore Printing and Publishing Co. Ltd., No. 88, Mysore Road, Bangalore - 560018.
3. Tewari, Pankaj Kapoor, S.C., (1988). Mushroom cultivation, Mittal Publications, Delhi.
4. Nita Bahl (1984-1988) Hand book of Mushrooms, II Edition, Vol. I & Vol. II.
5. Biswas, S., M. Datta and S.V. Ngachan. 2011. Mushrooms: A Manual For Cultivation. PHI learning private Ltd., New Delhi, India.
6. Chang, S. and P.G. Miles. 2004. Mushrooms: cultivation, nutritional value, medicinal effect, and environmental impact. CRC Press. USA.
7. Miles, P.G. and S. Chang. 1997. Mushroom Biology:

Concise basics and current developments. World Scientific

Publishing Co. Pte.Ltd. Singapore.

Suggested activities: Growing spawn on laboratory prepared medium in petriplates and maintaining, preparing compost and compost beds, packing of beds, spawning, maintaining moisture, picking, blanching and packing. Collecting naturally growing mushrooms and identifying them properly, visits to mushroom houses.

Paper VIII-B-2: PRACTICAL SYLLABUS

1. Identification of different edible and poisonous mushrooms.
2. Microscopic and anatomical observations of different mushroom species.
3. Pure culture - preparation of medium (PDA and Oatmeal agar medium) sterilization.
4. Isolation and preparation of spawn under controlled conditions (preparation of mother spawn in saline bottle and polypropylene bag and their multiplication).
5. Types of Compost preparation and sterilization.
6. Mushroom bed preparation - paddy straw, sugarcane trash, maize straw, banana leaves/waste.
7. Inoculation and spawning of compost.
6. Incubation and harvesting of mushrooms (collection, drying and preservation).
7. Diseases of mushrooms (photographs).
8. Post-harvest technology steps (photographs).
9. Study tour to mushroom cultivation farms
11. Project work – cultivation of paddy straw/ oyster/white button mushrooms.

Domain skills expected to achieve: Identification of different edible species, skill in media and substrate preparation, isolation of pure culture for spawn, compost preparation, and practices in growing methods of different cultivated mushrooms, Postharvest handling and packing

SCHEME OF PRACTICAL EXAMINATION

PAPER – VIII-B-2 (Cluster Elective): Mushroom Culture and Technology

PRACTICAL- VIII-B-2: Cluster Elective (MODEL QUESTION PAPER)

Time: 3hrs

Max. Marks: 50

I. Prepare the culture medium for isolation of spawn and make the slants. Write the protocol for preparation of the medium (A)

20 marks

II. Write the protocol for preparation of compost (B)

08 marks

III. Comment on given specimens C, D and E

3x4 = 12 marks

IV. Report on Field visit

05 marks

V. Practical Record

05 marks

Total = 50 marks

KEY

A-PDA /Oatmeal agar medium

B- Paddy straw compost

C – Edible mushroom (Photograph)

D- Poisonous mushroom (Photograph)

E. Preservation technique (Photograph)

Cluster Electives - B

III B.Sc.: Botany Syllabus Semester- VI, Theory: Cluster Elective –B-3

PAPER – VIII-B-3 (Cluster Elective)

Paper VIII-B-3: Internship/ Project Work preferably either in an Institute or Industry

B.Sc - BOTANY
SEMESTER-V/VI: THEORY MODEL PAPER
(General Model Paper)

Time: 3 Hours

Max. Marks:75

SECTION-A (Short Answer Questions)

*(Instructions to the paper setter: Set minimum ONE question from each unit, maximum **Eight** from all.)*

Answer any five of the following question

5x5=25M

- 1.
- 2.
- 3.
- 4.
- 5.
- 6.
- 7.
- 8.

SECTION-B (Essay Questions)

*(Instructions to the paper setter: Set minimum **two** questions from each unit, either or internal choice)*

Answer All of the following questions

5x10=50M

9. a)

Or

from unit I

b)

10. a)

Or

from unit II

b)

11. a)

Or

from unit III

b)

12. a)

Or

from unit IV

b)

13. a)

Or

from unit V

b)

INTERNAL EXAMS

- 25Marks

(15 marks for unit tests, 5 marks for assignments and remaining 5 marks for seminar etc.)

A.P. State Council of Higher Education
Revised Common Framework of CBCS for Colleges in Andhra Pradesh
w.e.f. 2015-16, Revised in April, 2016

Table-7: B.Sc., SEMESTER – I

Sno	Course	Total Marks	Mid Sem Exam*	Sem End Exam	Teaching Hours	Credits
1	First Language (Tel/Hin/Urdu/Sans...)	100	25	75	4	3
2	Second Language English	100	25	75	4	3
3	Foundation Course - 1 Human Values & Professional Ethics	50	0	50	2	2
4	Foundation course -2 Environmental Studies	50	0	50	2	2
5	DSC-1 Paper-1 (Core)	100	25	75	4	3
6	DSC 1 Lab Practical	50	0	50	2	2
7	DSC 2 Paper-1 (Core)	100	25	75	4	3
8	DSC 2 Lab Practical	50	0	50	2	2
9	DSC 3 Paper-1 (Core)	100	25	75	4	3
10	DSC 3 A Lab Practical	50	0	50	2	2
	Total	750	-	-	30	25

#DSC: Domain (Subject) Specific Course (Paper)

Foundation Course: value or skill based

Note: For Science Domain Subjects which had no lab practical component earlier (eg. Mathematics) the following format is applicable. They, however, will have co-curricular activities (eg. Problem solving sessions etc.). The total marks will change accordingly for such combinations. For example for Maths, Physics and Chemistry the total marks will be 700.

	DSC (without Lab Practical)	100	25	75	6	5
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*Mid sem exam at the college (The marks split between Formal Test and Co-curricular activities may be decided by the University concerned). End Sem Exam by the Univ.

*Practical component will not be applicable to those science subjects which had no such component earlier (ex. Mathematics)

**Syllabus size shall be in accordance with the number of teaching hours

Table-8: B.Sc., SEMESTER – II

Sno	Course	Total Marks	Mid Sem Exam	Sem End Exam	Teaching Hours	Credits
1	First Language	100	25	75	4	3

	(Tel/Hin/Urdu/Sans...)					
2	Second Language English	100	25	75	4	3
3	Foundation course – 3 ICT – I	50	0	50	2	2
4	Foundation course – 4 CSS – I	50	0	50	2	2
5	DSC 1 Paper-2 (Core)	100	25	75	4	3
6	DSC 1 Lab Practical	50	0	50	2	2
7	DSC 2 Paper-2 (Core)	100	25	75	4	3
8	DSC 2 Lab Practical	50	0	50	2	2
9	DSC 3 Paper-2 (Core)	100	25	75	4	3
10	DSC 3 Lab Practical	50	0	50	2	2
	Total	750	-	-	30	25

B.Sc. Table-9: B.Sc., SEMESTER – III

SEMESTER – III

Sno	Course	Total Marks	Mid Sem Exam	Sem End Exam	Teaching Hours	Credits
1	First Language (Tel/Hin/Urdu/Sans...)	100	25	75	4	3
2	Second Language English	100	25	75	4	3
3	Foundation Course - 5 ICT – II	50	0	50	2	2
4	Foundation course – 6 CSS – II	50	0	50	2	2
5	DSC 1 Paper-3	100	25	75	4	3

	(Core)					
6	DSC 1 Practical	50	0	50	2	2
7	DSC 2 Paper-3 (Core)	100	25	75	4	3
8	DSC 2 Practical	50	0	50	2	2
9	DSC 3 Paper-3 (Core)	100	25	75	4	3
10	DSC 3 Practical	50	0	50	2	2
	Total	750	-	-	30	25

Table-10: B.Sc., SEMESTER – IV

SEMESTER – IV

Sno	Course	Total Marks	Mid Sem Exam*	Sem End Exam	Teaching Hours**	Credits
1	<i>Foundation Course – 7</i> CSS – 2	50	0	50	2	2
2	<i>Foundation Course – 8</i> Analytical Skills	50	0	50	2	2
3	<i>Foundation Course - 9</i> Entrepreneurship	50	0	50	2	2
4	<i>Foundation course – 10</i> Leadership Education	50	0	50	2	2
5	DSC 1 Paper-4 (Core)	100	25	75	4	3
6	DSC 1 Lab Practical	50	0	50	2	2
7	DSC 2 Paper-4 (Core)	100	25	75	4	3
8	DSC 2 Lab Practical	50	0	50	2	2
9	DSC 3 Paper-4	100	25	75	4	3

	(Core)					
10	DSC 3 Lab Practical	50	0	50	2	2
	Total	750	-	-	30	23

*Analytical Skills: To be taught by Maths/Stat Teachers (may be partly by English Teachers)

Entrepreneurship: To be taught by Commerce Teachers

Leadership Education: To be taught by Telugu Teachers

Table-11: B.Sc., SEMESTER – V

Sno	Course	Total Marks	Mid Sem Exam	Sem End Exam	Teaching Hours	Credits
1	DSC 1 Paper-5 (Core)	100	25	75	3	3
2	DSC 1 Lab Practical	50	0	50	2	2
3	DSC 2 Paper-5 (Core)	100	25	75	3	3
4	DSC 2 Lab Practical	50	0	50	2	2
5	DSC 3 Paper-5 (Core)	100	25	75	3	3
6	DSC 3 Lab Practical	50	0	50	2	2
7	DSC 1 Paper-6 (Core)	100	25	75	3	3
8	DSC 1 Lab Practical	50	0	50	2	2
9	DSC 2 Paper -6 (Core)	100	25	75	3	3
10	DSC 2 Lab Practical	50	0	50	2	2
11	DSC 3 Paper-6 (Core)	100	25	75	3	3
12	DSC 3 Lab Practical	50	0	50	2	2

	Total	900	-	-	30	30
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Table-12: B.Sc., SEMESTER – VI

Sno	Course	Total Marks	Mid Sem Exam	Sem End Exam	Teaching Hours	Credits
1	Elective 1: DSC 1, Paper -7 (applied/adv)	100	25	75	3	3
2	Elective-1 Lab Practical	50	0	50	2	2
3	Elective-1: DSC 2, Paper -7 (applied/adv)	100	25	75	3	3
4	Elective-2 Lab Practical	50	0	50	2	2
5	Elective-1: DSC 3, Paper -7 (applied/adv)	100	25	75	3	3
6	Elective-3 Lab Practical	50	0	50	2	2
7	Elective -2: DSC 1, Paper -8 App/Inter-domain/Gen EI	100	25	75	3	3
8	Elective-2 Lab Practical	50	0	50	2	2
9	Elective -2: DSC 2, Paper -8 App/Inter-domain/Gen EI	100	25	75	3	3
10	Elective-2 Lab Practical	50	0	50	2	2
11	Elective -2: DSC 3, Paper -8 App/Inter-domain/Gen EI	100	25	75	3	3
12	Elective-2 Lab Practical	50	0	50	2	2
	Total	900	-	-	30	30

*7th paper of each of the domain specific subjects (1st paper of semester VI) will be a domain related Elective. More than one Elective may be offered giving choice to students. The Electives may be of Domain specific applied or advanced (specialization) in nature. The number of Electives may be decided (along with the syllabus) by the University concerned keeping the feasibility of conduct of University examinations in view.

** Applied Elective: It is desirable that around 25% of syllabus is taught by field experts. The college has to make such an arrangement.

*8th paper of each of the domain specific subjects (2nd paper of semester VI) will also be an Elective. The Electives may be of Inter-domain Clusters** - each Cluster having three papers with or without project work, or General in nature. The number of Clusters may be decided (along with the syllabus) by the University concerned keeping the feasibility of conduct of University examinations in view. It is desirable that around 25% of syllabus is taught by field experts.

****Cluster:** *In the last semester, for paper-8, each domain subject has one elective totaling three papers for each student. Electives may be given as Clusters of three papers each for each subject. A student can opt for all the three papers of the same subject (cluster or stream) including or excluding project work for a wider learning experience. The student will not study the other two domain subjects for paper-8.*

Total Credits for a B.Sc. Course: 158



ANDHRA PRADESH STATE COUNCIL OF HIGHER EDUCATION

(A Statutory body of the Government of Andhra Pradesh)

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REVISED SYLLABUS OF BOTANY UNDER CBCS FRAMEWORK WITH EFFECT FROM 2020-2021

PROGRAMME: THREE-YEAR BOTANY

*(With Learning Outcomes, Unit-wise Syllabus, References, Co-curricular Activities &
Model Q.P.)*

For Fifteen Courses of 1, 2, 3 & 4 Semesters)

(To be Implemented from 2020-21 Academic Year)

APSCHE/ REVISION OF C.B.C.S – BOTANY COURSE W.E.F.2020-21

S. No.	Semester	Title of the Course (Paper)	Hours /week	Max. Marks (SEE)	Marks in CIA	Credits
1.	Sem.-I/ Course-1	Fundamentals of Microbes and Non-vascular Plants	04	75	25	03
	Course-1 Practical	Fundamentals of Microbes and Non-vascular Plants	03	Max. Marks-50 Internal assessment at Semester end		02
2.	Sem.-II/ Course-2	Basics of Vascular plants and Phytogeography	04	75	25	03
	Course-2 Practical	Basics of Vascular plants and Phytogeography	03	Max. Marks-50 External assessment at Semester end		02
3.	Sem.-III/ Course-3	Anatomy and Embryology of Angiosperms, Plant Ecology and Biodiversity	04	75	25	03
	Course-3 Practical	Anatomy and Embryology of Angiosperms, Plant Ecology and Biodiversity	03	Max. Marks-50 Internal assessment at Semester end		02
4.	Sem.-IV Course-4	Plant Physiology and Metabolism	03	75	25	03
	Course-4 Practical	Plant Physiology and Metabolism	03	Max. Marks-50 External assessment at Semester end		02
5.	Sem.- IV Course- 5	Cell Biology, Genetics and Plant Breeding	04	75	25	03
	Course-5 Practical	Cell Biology, Genetics and Plant Breeding	03	Max. Marks-50 External assessment at Semester end		02
6.	Sem.- V Course – 6 & 7	Domain related Skill Enhancement Courses (02)	03	75	25	03
		- Three (3) pairs of courses (each pair has 2 related courses) will be offered, student has to choose a pair of courses.	03	Max. Marks-50 Internal assessment at Semester end		02
			03	75	25	03
			03	Max. Marks-50 Internal assessment at Semester end		02

CBCS / Semester System (w.e.f. 2020-'21 Admitted Batch)

I Semester /Botany Core Course - 1

Fundamentals of Microbes and Non-vascular Plants

(Viruses, Bacteria, Fungi, Lichens, Algae and Bryophytes)

(Total hours of teaching – 60 @ 04 Hrs./Week)

Theory:

Learning Outcomes:

On successful completion of this course, the students will be able to:

- Explain origin of life on the earth.
 - Illustrate diversity among the viruses and prokaryotic organisms and can categorize them.
 - Classify fungi, lichens, algae and bryophytes based on their structure, reproduction and life cycles.
 - Analyze and ascertain the plant disease symptoms due to viruses, bacteria and fungi.
 - Recall and explain the evolutionary trends among amphibians of plant kingdom for their shift to land habitat.
 - Evaluate the ecological and economic value of microbes, thallophytes and bryophytes.
-

Unit – 1: Origin of life and Viruses

12Hrs.

1. Origin of life, concept of primary Abiogenesis; Miller and Urey experiment. Five kingdom classification of R.H. Whittaker
2. Discovery of microorganisms, Pasteur experiments, germ theory of diseases.
3. Shape and symmetry of viruses; structure of TMV and Gemini virus; multiplication of TMV; A brief account of Prions and Viroids.
4. A general account on symptoms of plant diseases caused by Viruses. Transmission of plant viruses and their control.
5. Significance of viruses in vaccine production, bio-pesticides and as cloning vectors.

Unit – 2: Special groups of Bacteria and Eubacteria

12Hrs.

1. Brief account of Archaeobacteria, Actinomycetes and Cyanobacteria.
2. Cell structure and nutrition of Eubacteria.

3. Reproduction- Asexual (Binary fission and endospores) and bacterial recombination (Conjugation, Transformation, Transduction).
4. Economic importance of Bacteria with reference to their role in Agriculture and industry (fermentation and medicine).
5. A general account on symptoms of plant diseases caused by Bacteria; Citrus canker.

Unit – 3: Fungi & Lichens

12 Hrs.

1. General characteristics of fungi and Ainsworth classification (upto classes).
2. Structure, reproduction and life history of (a) *Rhizopus* (Zygomycota) and (b) *Puccinia* (Basidiomycota).
3. Economic uses of fungi in food industry, pharmacy and agriculture.
4. A general account on symptoms of plant diseases caused by Fungi; Blast of Rice.
5. Lichens- structure and reproduction; ecological and economic importance.

Unit – 4: Algae

12 Hrs.

1. General characteristics of Algae (pigments, flagella and reserve food material); Fritsch classification (upto classes).
2. Thallus organization and life cycles in Algae.
3. Occurrence, structure, reproduction and life cycle of (a) *Spirogyra* (Chlorophyceae) and (b) *Polysiphonia* (Rhodophyceae).
4. Economic importance of Algae.

Unit – 5: Bryophytes

12 Hrs.

1. General characteristics of Bryophytes; classification upto classes.
2. Occurrence, morphology, anatomy, reproduction (developmental details are not needed) and life cycle of (a) *Marchantia* (Hepaticopsida) and (b) *Funaria* (Bryopsida).
3. General account on evolution of sporophytes in Bryophyta.

Text books:

- Botany – I (Vrukshasastram-I) : Telugu Akademi, Hyderabad
- Pandey, B.P. (2013) *College Botany, Volume-I*, S. Chand Publishing, New Delhi
- Hait,G., K.Bhattacharya&A.K.Ghosh (2011) *A Text Book of Botany, Volume-I*, New Central Book Agency Pvt. Ltd., Kolkata
- Bhattacharjee, R.N., (2017) *Introduction to Microbiology and Microbial Diversity*, Kalyani Publishers, New Delhi.

Books for Reference:

- Dubey, R.C. &D.K.Maheswari (2013) *A Text Book of Microbiology*,S.Chand& Company Ltd., New Delhi
- Pelczar Jr., M.J., E.C.N. Chan &N.R.Krieg (2001)*Microbiology*, Tata McGraw-Hill Co, New Delhi
- Prescott, L. Harley, J. and Klein, D. (2005)*Microbiology, 6th edition*, Tata McGraw –Hill Co. New Delhi.
- Alexopoulos, C.J., C.W.Mims&M.Blackwell (2007) *Introductory Mycology*,Wiley& Sons, Inc., New York
- Mehrotra, R.S. & K. R. Aneja (1990)*An Introduction to Mycology*. New Age International Publishers, New Delhi
- Kevin Kavanagh (2005) *Fungi ; Biology and Applications* John Wiley & Sons, Ltd.,West Sussex, England
- John Webster & R. W. S. Weber (2007) *Introduction to Fungi*,Cambridge University Press, New York
- Fritsch, F.E. (1945)*The Structure & Reproduction of Algae (Vol. I & Vol. II)*Cambridge UniversityPress Cambridge, U.K..
- Bold, H.C. & M. J. Wynne (1984)*Introduction to the Algae*, Prentice-Hall Inc., New Jersey
- Robert Edward Lee (2008)*Phycology*. Cambridge University Press, New York
- Van Den Hoek, C., D.G.Mann&H.M.Jahns (1996)*Algae : An Introduction to Phycology*. Cambridge University Press, New York
- Shaw, A.J.&B.Goffinet (2000)*Bryophyte Biology*.Cambridge University Press, New York.

Practical syllabus of Botany Core Course – 1/ Semester – I

Fundamentals of Microbes and Non-vascular Plants

(Viruses, Bacteria, Fungi, Lichens, Algae and Bryophytes)

(Total hours of laboratory exercises 30 Hrs. @ 02 Hrs./Week)

Course Outcomes: On successful completion of this practical course, student shall be able to;

1. Demonstrate the techniques of use of lab equipment, preparing slides and identify the material and draw diagrams exactly as it appears.
2. Observe and identify microbes and lower groups of plants on their own.
3. Demonstrate the techniques of inoculation, preparation of media etc.
4. Identify the material in the permanent slides etc.

Practical Syllabus:

1. Knowledge of Microbiology laboratory practices and safety rules.
2. Knowledge of different equipment for Microbiology laboratory (Spirit lamp, Inoculation loop, Hot-air oven, Autoclave/Pressure cooker, Laminar air flow chamber and Incubator) and their working principles. (In case of the non-availability of the laboratory equipment the students can be taken to the local college/clinical lab. with required infrastructural facilities or they can enter a linkage with the college/lab for future developments and it will fetch credits during the accreditation by NAAC).
3. Demonstration of Gram's staining technique for Bacteria.
4. Study of Viruses (Corona, Gemini and TMV) using electron micrographs/ models.
5. Study of Archaeobacteria and Actinomycetes using permanent slides/ electron micrographs/diagrams.
6. Study of *Anabaena* and *Oscillatoria* using permanent/temporary slides.
7. Study of different bacteria (Cocci, Bacillus, Vibrio and Spirillum) using permanent or temporary slides/ electron micrographs/ diagrams.
8. Study/ microscopic observation of vegetative, sectional/anatomical and reproductive structures of the following using temporary or permanent slides/ specimens/ mounts :
 - a. Fungi : *Rhizopus*, *Penicillium* and *Puccinia*

- b. Lichens: Crustose, foliose and fruticose
 - c. Algae : *Volvox*, *Spirogyra*, *Ectocarpus* and *Polysiphonia*
 - d. Bryophyta : *Marchantia* and *Funaria*
9. Study of specimens of Tobacco mosaic disease, Citrus canker and Blast of Rice.

Model Question Paper for Practical Examination

Semester – I/ Botany Core Course – 1

Fundamentals of Microbes and Non-vascular Plants

(Viruses, Bacteria, Fungi, Lichens, Algae and Bryophytes)

Max. Time: 3 Hrs.

Max. Marks: 50

1. Take the T.S. of material 'A' (Fungi), make a temporary mount and make comments about identification. 10 M
2. Identify any 2 algae from the mixture (material 'B') given with specific comments about identification. 10 M
3. Take the T.S. of material 'C' (Bryophyta), make a temporary mount and make comments about identification. 10 M
4. Identify the following with specific reasons. 4x 3 = 12 M
D. A laboratory equipment of Microbiology
E. Virus
F. Archaeobacteria /Ascomycete /Cyanobacteria/ Eu-Bacteria
G. Lichen
5. Record + Viva-voce 5+3 = 8 M

Suggested co-curricular activities for Botany Core Course-1 in Semester-I:

A. Measurable :

a. Student seminars :

1. Baltimore classification of Viruses.
2. Lytic and lysogenic cycle of T- even Bacteriophages.
3. Viral diseases of humans and animals.
4. Retroviruses
5. Bacterial diseases of humans and animals.
6. Significance of Bacteria in Biotechnology and Genetic engineering.
7. Fungi responsible for major famines in the world.
8. Poisonous mushrooms (Toad stools).
9. Algae as Single Cell Proteins (SCPs)
10. Parasitic algae

11. Origin of Bryophytes through : Algae vsPteridophytes
12. Fossil Bryophytes
13. Evolution of gametophytes in Bryophyta.
14. Ecological and economic importance of Bryophytes.

b. Student Study Projects :

1. Isolation and identification of microbes from soil, water and air.
2. Collection and identification of algae from fresh /estuarine /marine water.
3. Collection and identification of fruiting bodies of Basidiomycetes and Ascomycetes.
4. Collection and identification of Lichens from their native localities.
5. Collection of diseased plants/parts and identification of symptoms.
6. Collection and identification of Bryophytes from their native localities.

c. Assignments: Written assignment at home / during '0' hour at college; preparation of charts with drawings, making models etc., on topics included in syllabus.

B. General :

1. Visit to Agriculture and/or Horticulture University/College/Research station to learn about microbial diseases of plants.
2. Visit to industries working on microbial, fungal and algal products.
3. Group Discussion (GD)/ Quiz/ Just A Minute (JAM) on different modules in syllabus of the course.

II Semester /Botany Core Course – 2
Basics of Vascular plants and Phytogeography
(Pteridophytes, Gymnosperms, Taxonomy of Angiosperms and Phytogeography)
(Total hours of teaching – 60 @ 02 Hrs./Week)

Theory:

Learning Outcomes:

On successful completion of this course, the students will be able to:

- Classify and compare Pteridophytes and Gymnosperms based on their morphology, anatomy, reproduction and life cycles.
 - Justify evolutionary trends in tracheophytes to adapt for land habitat.
 - Explain the process of fossilization and compare the characteristics of extinct and extant plants.
 - Critically understand various taxonomical aids for identification of Angiosperms.
 - Analyze the morphology of the most common Angiosperm plants of their localities and recognize their families.
 - Evaluate the ecological, ethnic and economic value of different tracheophytes and summarize their goods and services for human welfare.
 - Locate different phytogeographical regions of the world and India and can analyze their floristic wealth.
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Unit – 1: Pteridophytes

12 Hrs.

1. General characteristics of Pteridophyta; classification of Smith (1955) into divisions.
2. Occurrence, morphology, anatomy, reproduction (developmental details are not needed) and life history of (a) *Lycopodium* (Lycopsida) and (b) *Marsilea* (Filicopsida).
3. Stellar evolution in Pteridophytes;
4. Heterospory and seed habit.

Unit – 2:Gymnosperms **14 Hrs.**

1. General characteristics of Gymnosperms; Sporneclassification upto classes.
2. Occurrence, morphology, anatomy, reproduction (developmental details are not needed) and life history of (a) *Cycas*(Cycadopsida) and (b) *Gnetum* (Gnetopsida).
3. Outlines of geological time scale.
4. A brief account on *Cycadeoidea*.

Unit – 3:Basic aspects of Taxonomy **13Hrs.**

1. Aim and scope of taxonomy; Species concept: Taxonomic hierarchy, species, genus and family.
2. Plant nomenclature: Binomial system, ICBN- rules for nomenclature.
3. Herbarium and its techniques,BSI herbarium and Kew herbarium; concept of digital herbaria.
4. Bentham and Hooker system of classification;
5. Systematic description and economic importance of the following families:
(a) Annonaceae (b) Curcubitaceae

Unit – 4: Systematic Taxonomy **13 Hrs.**

1. Systematic description and economic importance of the following families:
(a) Asteraceae (b) Asclepiadaceae (c)Amaranthaceae(d) Euphorbiaceae
(e) Arecaceaeand (f) Poaceae
2. Outlines of Angiosperm Phylogeny Group (APG IV).

Unit – 5:Phytogeography **08 Hrs.**

1. Principles of Phytogeography, Distribution (wides, endemic, discontinuous species)
2. Endemism – types and causes.
3. Phytogeographic regions of World.
4. Phytogeographic regions of India.
5. Vegetation types in Andhra Pradesh.

Text books:

- Botany – I (Vrukshasastram-I) : Telugu Akademi, Hyderabad
- Botany – II (Vrukshasastram-II) : Telugu Akademi, Hyderabad
- Acharya, B.C., (2019) *Archhegoniates*, Kalyani Publishers, New Delhi
- Bhattacharya, K., G. Hait&Ghosh, A. K., (2011) *A Text Book of Botany, Volume-II*, New Central Book Agency Pvt. Ltd., Kolkata
- Hait,G., K.Bhattacharya&A.K.Ghosh (2011) *A Text Book of Botany, Volume-I*, New Central Book Agency Pvt. Ltd., Kolkata
- Pandey, B.P. (2013)*College Botany, Volume-I*, S. Chand Publishing, New Delhi
- Pandey, B.P. (2013)*College Botany, Volume-II*, S. Chand Publishing, New Delhi

Books for Reference:

- Smith, G.M. (1971)*Cryptogamic Botany Vol. II.*, Tata McGraw Hill, New Delhi
- Sharma,O.P.(2012)*Pteridophyta*. Tata McGraw-Hill, New Delhi
- Kramer, K.U.&P. S. Green (1990) *The Families and Genera of Vascular Plants, Volume –I: Pteridophytes and Gymnosperms*(Ed.K.Kubitzki) Sprunge-Verlag, New York
- Bhatnagar, S.P. &AlokMoitra (1996)*Gymnosperms*. New Age International, New Delhi
- Coulter, J.M. &C.J.Chamberlain(1910) *Morphology of Gymnosperms*,The University of Chicago Press, Chicago, Illinois
- Govil, C.M. (2007)*Gymnosperms : Extinct and Extant*. KRISHNA Prakashan Media (P) Ltd.Meerut& Delhi
- Sporne, K.R.(1971)*The Morphology of Gymnosperms*.Hutchinsons Co. Ltd., London
- Arnold, C.A., (1947) *An introduction to Paleobotany*McGraw –Hill Book Company,INC, New York
- Stewart,W.N., and G.W.Rothwell (2005) *Paleobotany and the evolution of plants* Cambridge University Press, New York
- Lawrence, George H.M. (1951) *Taxonomy of Vascular Plants*. The McMillan Co., New York
- Heywood, V. H. and D. M. Moore (1984)*Current Concepts in Plant Taxonomy*. Academic Press, London.

- Jeffrey, C. (1982)*An Introduction to Plant Taxonomy*. Cambridge University Press, Cambridge. London.
- Sambamurty, A.V.S.S. (2005)*Taxonomy of Angiosperms I*. K .International Pvt. Ltd., New Delhi
- Singh, G. (2012). *Plant Systematics: Theory and Practice*.Oxford & IBH Pvt. Ltd., NewDelhi.
- Simpson, M.G. (2006). *Plant Systematics*. Elsevier Academic Press, San Diego, CA,U.S.A.
- Cain, S.A . (1944)*Foundations of Plant Geography*Harper & Brothers, N.Y.
- Good, R. (1997)*The Geography of flowering Plants (2nd Edn.)*Longmans, Green & Co., Inc., London & Allied Science Publishers, New Delhi
- Mani, M.S (1974)*Ecology & Biogeography of India*Dr. W. Junk Publishers, The Haque

Practical syllabus of Botany Core Course – 2/ Semester – II

Basics of Vascular plants and Phyto geography

(Pteridophytes, Gymnosperms, Taxonomy of Angiosperms and Phyto geography) (Total hours of laboratory exercises 30 Hrs. @ 02 Hrs. /Week)

Course Outcomes:

On successful completion of this course students shall be able to:

1. Demonstrate the techniques of section cutting, preparing slides, identifying of the material and drawing exact figures.
2. Compare and contrast the morphological, anatomical and reproductive features of vascular plants.
3. Identify the local angiosperms of the families prescribed to their genus and species level and prepare herbarium.
4. Exhibit skills of preparing slides, identifying the given twigs in the lab and drawing figures of plant twigs, flowers and floral diagrams as they are.
5. Prepare and preserve specimens of local wild plants using herbarium techniques.

Practical Syllabus:

1. Study/ microscopic observation of vegetative, sectional/anatomical and reproductive structures of the following using temporary or permanent slides/ specimens/ mounts :
 - a. Pteridophyta : *Lycopodium* and *Marselia*
 - b. Gymnosperms : *Cycas* and *Gnetum*
2. Study of fossil specimens of *Cycadeoidea* and *Pentoxylon* (photographs /diagrams can be shown if specimens are not available).
3. Demonstration of herbarium techniques.
4. Systematic / taxonomic study of locally available plants belonging to the families prescribed in theory syllabus. (Submission of 30 number of Herbarium sheets of wild plants with the standard system is mandatory).
5. Mapping of phytogeographical regions of the globe and India.

Model Question Paper for Practical Examination

Semester – II/ Botany Core Course – 2

Basics of Vascular plants and Phytogeography

(Pteridophytes, Gymnosperms, Taxonomy of Angiosperms and Phytogeography)

Max. Time: 3 Hrs.

Max. Marks: 50

1. Take T.S. of the material 'A' (Pteridophyta), make a temporary slide and justify the identification with apt points. 10 M
2. Take T.S. of the material 'B' (Gymnosperms), make a temporary slide and justify the identification with apt points. 10 M
3. Describe the vegetative and floral characters of the material 'C' (Taxonomy of Angiosperms) and derive its systematic position. 10 M
4. Identify the specimen 'D' (Fossil Gymnosperm) and give specific reasons. 5 M
5. Locate the specified phytogeographical regions (2x2M) in the world / India (E) map supplied to you. 4 M
6. Record + Herbarium & Field note book + Viva-voce 5 +4+3 = 12 M

Suggested co-curricular activities for Botany Core Course-2 in Semester-II:

A. Measurable :

a. Student seminars :

1. Fossil Pteridophytes.
2. Aquatic ferns and tree ferns
3. Ecological and economic importance of Pteridophytes
4. Evolution of male and female gametophytes in Gymnosperms.
5. Endemic and endangered Gymnosperms.
6. Ecological and economic importance of Gymnosperms.
7. Floras and their importance: Flora of British India and Flora of Madras Presidency.
8. Botanical gardens and their importance: National Botanic garden and Royal Botanic garden.
9. Artificial, Natural and Phylogenetic classification systems.
10. Molecular markers used in APG system of classification.
11. Vessel less angiosperms.

12. Insectivorous plants.
13. Parasitic angiosperms.
14. Continental drift theory and species isolation.

b. Student Study Projects :

1. Collection and identification of Pteridophytes from their native locality/ making an album by collecting photographs of Pteridophytes.
 2. Collection and identification of Gymnosperms from their native locality/ making an album by collecting photographs of Gymnosperms.
 4. Collection of information on famous herbaria in the world and preparation of a report.
 5. Collection of information on famous botanic gardens in the world and preparation of a report.
 6. Collection of data on vegetables (leafy and fruity) plants in the market and preparation of a report on their taxonomy.
 7. Collection and identification of fresh and dry fruits plants in the market and preparation of a report on their taxonomy.
 7. Collection of data on plants of ethnic and ethnobotanical importance from their native locality.
 9. Preparation of a local flora by enlisting the plants of their native place.
- c. Assignments:** Written assignment at home / during '0' hour at college; preparation of charts with drawings, making models etc., on topics included in syllabus.

B. General :

1. Visit to Botanic garden in a Research institute/University to see the live plants.
2. Virtual tour in websites for digital herbaria and botanic gardens.
3. Acquaint with standard floras like – Flora of Madras Presidency, Flora of their respective district in Andhra Pradesh.
4. Looking into vegetation of different phytogeographical regions using web resources.
5. Group Discussion (GD)/ Quiz/ Just A Minute (JAM) on different modules in syllabus of the course.

III Semester /Botany Core Course - 3

Anatomy and Embryology of Angiosperms, Plant Ecology and Biodiversity

(Total hours of teaching – 60 @ 04 Hrs./Week)

Theory:

Learning outcomes:

On successful completion of this course, the students will be able to;

- Understand on the organization of tissues and tissue systems in plants.
 - Illustrate and interpret various aspects of embryology.
 - Discuss the basic concepts of plant ecology, and evaluate the effects of environmental and biotic factors on plant communities.
 - Appraise various qualitative and quantitative parameters to study the population and community ecology.
 - Correlate the importance of biodiversity and consequences due to its loss.
 - Enlist the endemic/endangered flora and fauna from two biodiversity hot spots in India and assess strategies for their conservation.
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Unit – 1: Anatomy of Angiosperms

12 Hrs.

1. Organization of apical meristems: Tunica-carpus theory and Histogen theory.
2. Tissue systems—Epidermal, ground and vascular.
3. Anomalous secondary growth in *Boerhaavia* and *Dracaena*.
4. Study of timbers of economic importance - Teak, Red sanders and Rosewood.

Unit – 2: Embryology of Angiosperms

12 Hrs.

1. Structure of anther, anther wall, types of tapetum. Microsporogenesis and development of male gametophyte.
2. Structure of ovule, megasporogenesis; monosporic (*Polygonum*), bisporic (*Allium*) and tetrasporic (*Peperomia*) types of embryo sacs.
3. Outlines of pollination, pollen – pistil interaction and fertilization.
4. Endosperm - Types and biological importance - Free nuclear, cellular, helobial and ruminate.
5. Development of Dicot (*Capsella bursa-pastoris*) embryo.

Unit – 3: Basics of Ecology**12 Hrs.**

1. Ecology: definition, branches and significance of ecology.
2. Ecosystem: Concept and components, energy flow, food chain, food web, ecological pyramids.
4. Plants and environment: Climatic (light and temperature), edaphic and biotic factors.
5. Ecological succession: Hydrosere and Xerosere.

Unit – 4: Population, Community and Production Ecology**12 Hrs.**

1. Population ecology: Natality, mortality, growth curves, ecotypes, ecads
2. Community ecology: Frequency, density, cover, life forms, biological spectrum
3. Concepts of productivity: GPP, NPP and Community Respiration
4. Secondary production, P/R ratio and Ecosystems.

Unit – 5: Basics of Biodiversity**12 Hrs.**

1. Biodiversity: Basic concepts, Convention on Biodiversity - Earth Summit.
 2. Value of Biodiversity; types and levels of biodiversity and Threats to biodiversity
 3. Biodiversity Hot spots in India. Biodiversity in North Eastern Himalayas and Western Ghats.
 4. Principles of conservation: IUCN threat-categories, RED data book
 5. Role of NBPGR and NBA in the conservation of Biodiversity.
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Text books:

- Botany – III (Vrukshasastram-I) : Telugu Akademi, Hyderabad
- Botany – IV (Vrukshasastram-II) : Telugu Akademi, Hyderabad
- Pandey, B.P. (2013) *College Botany, Volume-II*, S. Chand Publishing, New Delhi
- Pandey, B.P. (2013) *College Botany, Volume-III*, S. Chand Publishing, New Delhi
- Bhattacharya, K., G. Hait & Ghosh, A. K., (2011) *A Text Book of Botany, Volume-II*, New Central Book Agency Pvt. Ltd., Kolkata

Books for Reference:

- Esau, K. (1971) *Anatomy of Seed Plants*. John Wiley and Son, USA.
- Fahn, A. (1990) *Plant Anatomy*, Pergamon Press, Oxford.
- Cutler, D.F., T. Botha & D. Wm. Stevenson (2008) *Plant Anatomy: An Applied Approach*, Wiley, USA.
- Paula Rudall (1987) *Anatomy of Flowering Plants: An Introduction to Structure and Development*. Cambridge University Press, London
- Bhojwani, S. S. and S. P. Bhatnagar (2000) *The Embryology of Angiosperms (4th Ed.)*, Vikas Publishing House, Delhi.
- Pandey, A. K. (2000) *Introduction to Embryology of Angiosperms*. CBS Publishers & Distributors Pvt. Ltd. , New Delhi
- Maheswari, P. (1971) *An Introduction to Embryology of Angiosperms*. McGraw Hill Book Co., London.
- Johri, B.M. (2011) *Embryology of Angiosperms*. Springer-Verlag, Berlin
- Pandey, B.P. (2013) *College Botany, Volume-III*, S. Chand Publishing, New Delhi
- Bhattacharya, K., A. K. Ghosh, & G. Hait (2011) *A Text Book of Botany, Volume-IV*, New Central Book Agency Pvt. Ltd., Kolkata
- Kormondy, Edward J. (1996) *Concepts of Ecology*, Prentice-Hall of India Private Limited, New Delhi
- Begon, M., J.L. Harper & C.R. Townsend (2003) *Ecology*, Blackwell Science Ltd., U.S.A.
- Eugene P. Odum (1996) *Fundamentals of Ecology*, Natraj Publishers, Dehradun
- Sharma, P.D. (2012) *Ecology and Environment*. Rastogi Publications, Meerut, India.
- N.S. Subrahmanyam & A.V.S.S. Sambamurty (2008) *Ecology* Narosa Publishing House, New Delhi

- A. K. Agrawal & P.P. Deo (2010) *Plant Ecology*, Agrobios (India), Jodhpur
- Kumar, H.D. (1992) *Modern Concepts of Ecology (7th Edn.,)* Vikas Publishing Co.,
New Delhi.
- Newman, E.I. (2000): *Applied Ecology* Blackwell Scientific Publisher, U.K.
- Chapman, J.L. & M.J. Reiss (1992): *Ecology - Principles & Applications*. Cambridge University Press, U.K.
- Kumar H.D. (2000) *Biodiversity & Sustainable Conservation* Oxford & IBH Publishing Co Ltd. New Delhi.
- U. Kumar (2007) *Biodiversity : Principles & Conservation*, Agrobios (India), Jodhpur

Practical syllabus of Botany Core Course – 3 /Semester – III
Anatomy and Embryology of Angiosperms, Plant Ecology and Biodiversity

(Total hours of laboratory exercises 30 Hrs. @ 02 Hrs./Week)

Course Outcomes:

On successful completion of this practical course students shall be able to:

1. Get familiarized with techniques of section making, staining and microscopic study of vegetative, anatomical and reproductive structure of plants.
2. Observe externally and under microscope, identify and draw exact diagrams of the material in the lab.
3. Demonstrate application of methods in plant ecology and conservation of biodiversity and qualitative and quantitative aspects related to populations and communities of plants.

Practical Syllabus

1. Tissue organization in root and shoot apices using permanent slides.
2. Anomalous secondary growth in stems of *Boerhavia* and *Dracaena*.
3. Study of anther and ovule using permanent slides/photographs.
4. Study of pollen germination and pollen viability.
5. Dissection and observation of Embryo sac haustoria in *Santalum* or *Argemone*.
6. Structure of endosperm (nuclear and cellular) using permanent slides / Photographs.
7. Dissection and observation of Endosperm haustoria in *Crotalaria* or *Coccinia*.
8. Developmental stages of dicot and monocot embryos using permanent slides / photographs.
9. Study of instruments used to measure microclimatic variables; soil thermometer, maximum and minimum thermometer, anemometer, rain gauge, and lux meter. (visit to the nearest/local meteorology station where the data is being collected regularly and record the field visit summary for the submission in the practical).
10. Study of morphological and anatomical adaptations of hydrophytes and xerophytes (02 each).
11. Quantitative analysis of herbaceous vegetation in the college campus for frequency, density and abundance.

12. Identification of vegetation/various plants in college campus and comparison with Raunkiaer's frequency distribution law.
13. Find out the alpha-diversity of plants in the area
14. Mapping of biodiversity hotspots of the world and India.

Model paper for Practical Examination

Semester – III/ Botany Core Course – 3

Anatomy and Embryology of Angiosperms, Plant Ecology and Biodiversity

Max. Time: 3 Hrs.

Max. Marks: 50

1. Take T.S. of the material 'A' (Anatomy), prepare a temporary slide and justify the identification with specific reasons. 10 M
2. Write the procedure for the experiment 'B' (Embryology) and demonstrate the same. 10 M
3. Take T.S. of the material 'C', prepare a temporary slide and justify the identification with specific reasons. 10 M
4. Identify the following with specific reasons. 4 x 3 = 12 M
 - D. Anatomy/Embryology
 - E. Ecology instrument
 - F. Mapping of Biodiversity hot spot
 - G. Endemic/endangered plant/animal
5. Record + Viva-voce 5 + 3 = 8 M

Suggested co-curricular activities for Botany Core Course-3 in Semester-III:

A. Measurable :

a. Student seminars :

1. Anatomy in relation to taxonomy of Angiosperms.
2. Nodal anatomy
3. Floral anatomy
4. Embryology in relation to taxonomy of Angiosperms.
5. Apomictics and polyembryony.
6. Biogeochemical cycles- Carbon, Nitrogen and Phosphorous.
7. Deforestation and Afforestation.
8. Green house effect and ocean acidification.
9. The Montreal protocol and the Kyoto protocol.
10. Productivity of aquatic ecosystems.
11. Mangrove ecosystems in India.
12. Kollerulake – Ramsar site.
13. Biodiversity hotspots of the world.
14. Origin of Crop plants - Vavilov centers
15. Agrobiodiversity
16. International organizations working on conservation of Biodiversity
17. Nagoya protocol – ABS system.
18. Endemic and endangered plants in Andhra Pradesh.

b. Student Study Projects :

1. Stomata structure in plants from college campus/ their native place.
2. Report on xylem elements in plants using maceration technique.
3. Collection of information on famous herbaria in the world and preparation of a report.
4. Microscopic observations on pollen morphology from plants in college Campus/ their native locality.
5. Study report on germination and viability of pollen in different plants.
6. Observation of anthesis time in different plants and their pollinators.
7. A report on autecology and synecology of some plants in college campus or their native place.
8. Collection of photos of endemic/endangered plant and animal species to Makean album.

9. Biodiversity of the college or their own residential/ native area.
10. Collection of seeds/vegetative organs of rare plant species from their localities and to raise/grow in college garden

c. Assignments: Written assignment at home / during '0' hour at college; preparation of charts with drawings, making models etc., on topics included in syllabus.

B. General :

1. Visit to an arboretum/silviculture station/Forest research institute to see the live timber yielding plants or to visit a local timber depot. to observe various woods.
2. Field visit to a nearby ecosystem to observe the abiotic-biotic relationships.
3. Visit to National park/Sanctuary/Biosphere reserve etc., to observe in-situ conservation of plants and animals.
4. Visit to a Botanical garden or Zoo to learn about ex-situ conservation of rare plants or animals.
5. Group Discussion (GD)/ Quiz/ Just A Minute (JAM) on different modules in syllabus of the course.

IV Semester/ Botany Core Course – 4

Plant Physiology and Metabolism

(Total hours of teaching – 60 @ 04 Hrs./Week)

Theory:

Learning outcomes:

On successful completion of this course, the students will be able to;

- Comprehend the importance of water in plant life and mechanisms for transport of water and solutes in plants.
 - Evaluate the role of minerals in plant nutrition and their deficiency symptoms.
 - Interpret the role of enzymes in plant metabolism.
 - Critically understand the light reactions and carbon assimilation processes responsible for synthesis of food in plants.
 - Analyze the biochemical reactions in relation to Nitrogen and lipid metabolisms.
 - Evaluate the physiological factors that regulate growth and development in plants.
 - Examine the role of light on flowering and explain physiology of plants under stress conditions.
-

Unit – 1: Plant-Water relations

10 Hrs.

1. Importance of water to plant life, physical properties of water, diffusion, imbibition, osmosis. water potential, osmotic potential, pressure potential.
2. Absorption and lateral transport of water; Ascent of sap
3. Transpiration: stomata structure and mechanism of stomatal movements (K^+ ion flux).
4. Mechanism of phloem transport; source-sink relationships.

Unit – 2: Mineral nutrition, Enzymes and Respiration

14 Hrs.

1. Essential macro and micro mineral nutrients and their role in plants; symptoms of mineral deficiency
2. Absorption of mineral ions; passive and active processes.
3. Characteristics, nomenclature and classification of Enzymes. Mechanism of enzyme action, enzyme kinetics.

4. Respiration: Aerobic and Anaerobic; Glycolysis, Krebs cycle; electron transport system, mechanism of oxidative phosphorylation, Pentose Phosphate Pathway (HMP shunt).

Unit – 3: Photosynthesis and Photorespiration

12 Hrs.

1. Photosynthesis: Photosynthetic pigments, absorption and action spectra; Red drop and Emerson enhancement effect
2. Concept of two photosystems; mechanism of photosynthetic electron transport and evolution of oxygen; photophosphorylation
3. Carbon assimilation pathways (C₃, C₄ and CAM);
4. Photorespiration - C₂ pathway

Unit – 4: Nitrogen and lipid metabolism

12 Hrs.

1. Nitrogen metabolism: Biological nitrogen fixation – asymbiotic and symbiotic nitrogen fixing organisms. Nitrogenase enzyme system.
2. Lipid metabolism: Classification of Plant lipids, saturated and unsaturated fatty acids.
3. Anabolism of triglycerides, β -oxidation of fatty acids, Glyoxylate cycle.

Unit – 5: Plant growth - development and stress physiology

12 Hrs.

1. Growth and Development: Definition, phases and kinetics of growth.
 2. Physiological effects of Plant Growth Regulators (PGRs) - auxins, gibberellins, cytokinins, ABA, ethylene and brassinosteroids.
 3. Physiology of flowering: Photoperiodism, role of phytochrome in flowering.
 4. Seed germination and senescence; physiological changes.
-

Text books:

- Botany – IV (Vrukshasastram-II) : Telugu Akademi, Hyderabad
- Pandey, B.P. (2013) *College Botany, Volume-III*, S. Chand Publishing, New Delhi
- Ghosh, A. K., K. Bhattacharya & G. Hait (2011) *A Text Book of Botany, Volume-III*, New Central Book Agency Pvt. Ltd., Kolkata

Books for Reference:

- Aravind Kumar & S.S. Purohit (1998) *Plant Physiology – Fundamentals and Applications*, AgroBotanica, Bikaner
- Datta, S.C. (2007) *Plant Physiology*, New Age International (P) Ltd., Publishers, New Delhi
- Hans Mohr & P. Schopfer (2006) *Plant Physiology*, Springer (India) Pvt. Ltd., New Delhi
- Hans-Walter Heldt (2005) *Plant Biochemistry*, Academic Press, U.S.A.
- Hopkins, W.G. & N.P.A. Huner (2014) *Introduction to Plant Physiology*, Wiley India Pvt. Ltd., New Delhi
- Noggle Ray & J. Fritz (2013) *Introductory Plant Physiology*, Prentice Hall (India), New Delhi
- Pandey, S.M. & B.K. Sinha (2006) *Plant Physiology*, Vikas Publishing House, New Delhi
- Salisbury, Frank B. & Cleon W. Ross (2007) *Plant Physiology*, Thomsen & Wadsworth, Australia & U.S.A
- Sinha, R.K. (2014) *Modern Plant Physiology*, Narosa Publishing House, New Delhi
- Taiz, L. & E. Zeiger (2003) *Plant Physiology*, Panima Publishers, New Delhi
- Verma, V. (2007) *Text Book of Plant Physiology*, Ane Books India, New Delhi

Practical Syllabus of Botany Core Course – 4 / Semester – IV

Plant Physiology and Metabolism

(Total hours of laboratory exercises 30 Hrs. @ 02 Hrs. /Week)

Course outcomes: On successful completion of this practical course, students shall be able to:

1. Conduct lab and field experiments pertaining to Plant Physiology, that is, biophysical and biochemical processes using related glassware, equipment, chemicals and plant material.
2. Estimate the quantities and qualitative expressions using experimental results and calculations
3. Demonstrate the factors responsible for growth and development in plants.

Practical Syllabus

1. Determination of osmotic potential of plant cell sap by plasmolytic method using *Rhoeo/ Tradescantia* leaves.
2. Calculation of stomatal index and stomatal frequency of a mesophyte and a xerophyte.
3. Determination of rate of transpiration using Cobalt chloride method / Ganong's potometer (at least for a dicot and a monocot).
4. Effect of Temperature on membrane permeability by colorimetric method.
5. Study of mineral deficiency symptoms using plant material/photographs.
6. Demonstration of amylase enzyme activity and study the effect of substrate and Enzyme concentration.
7. Separation of chloroplast pigments using paper chromatography technique.
8. Demonstration of Polyphenol oxidase enzyme activity (Potato tuber or Apple fruit)
9. Anatomy of C₃, C₄ and CAM leaves

10. Estimation of protein by biuret method/Lowry method

11. Minor experiments – Osmosis, Arc-auxonometer, ascent of sap through xylem, cytoplasmic streaming.

Model Question Paper for Practical Examination

Semester – IV/ Botany Core Course – 4

Plant Physiology and Metabolism

Max. Time: 3 Hrs.

Max. Marks: 50

1. Conduct the experiment 'A' (Major experiment), write aim, principle, material and apparatus/equipment, procedure, tabulate results and make conclusion. 20 M
2. Demonstrate the experiment 'B' (Minor experiment), write the principle, procedure and give inference. 10 M
3. Identify the following with apt reasons. 3 x 4 = 12 M
 - C. Plant water relations / Mineral nutrition
 - D. Plant metabolism
 - E. Plant growth and development
4. Record + Viva-voce 5 + 3 = 8 M

Suggested co-curricular activities for Botany Core Course-4 in Semester-IV:

A. Measurable :

a. Student seminars :

1. Antitranspirants and their significance in crop physiology and horticulture.
2. Natural chelating agents in plants.
3. Criteria of essentiality of elements and beneficial elements.
4. Hydroponics, aquaponics and aeroponics.
5. Mycorrhizal association and mineral nutrition in plants.
6. Non-proteinaceous enzymes.
7. Respiratory inhibitors.
8. Structure of ATPase and Chemiosmotic hypothesis.
9. Transpiration and photosynthesis – a compromise.
10. Amphibolic pathways and bypass pathways in plants.
11. Non-biological nitrogen fixation.
12. Role of Hydrogenase in nitrogen fixation.
13. Plant lectins – their role in plants and use in medicine and medical research.

b. Student Study Projects :

1. Stomatal densities among different groups of plants.
2. Various treatments (salt, cold, high temperature, heavy metals) and their effects on seed germination.
3. Effects of plant hormones (IAA, Gibberellin and Kinetin) on Seed Germination.
4. Diurnal variation of stomatal behavior in CAM and C3 plants found in local area.
5. Effects of nitrogen fertilizer on plant growth.
6. Enumeration of C3, C4 and CAM plants in the local area.
7. Effect of different light wavelengths (red light, green light, blue light) on apparent photosynthesis in terms of growth.
8. Light effects on leaf growth and leaf orientation.
9. Artificial Fruit Ripening Process by various treatments (carbide and ethylene).
10. Study of relative water content and water retention by leaves under different environments.
11. Study of soil nutrients in local agricultural fields.
12. Study of mineral deficiency symptoms of various crops of local area.
13. Study of local weeds in crop fields.
14. Studies on seed storage proteins, oils and starch in local millets and pulse crops.
15. Making a report on LDPs, SDPs and DNPs in their locality.

c. Assignments: Written assignment at home / during '0' hour at college; preparation of charts with drawings, making models etc., on topics included in syllabus.

B. General :

1. Group Discussion (GD)/ Quiz/ Just A Minute (JAM) on different modules in syllabus of the course.
2. Visit to a Plant Physiology laboratory in a University or Physiology division in a Agriculture/Horticulture University/Research station.

IV Semester / Botany Core Course –5
Cell Biology, Genetics and Plant Breeding
(Total hours of teaching – 60 @ 04 Hrs./Week)

Theory:

Learning outcomes:

On successful completion of this course, the students will be able to:

- Distinguish prokaryotic and eukaryotic cells and design the model of a cell.
 - Explain the organization of a eukaryotic chromosome and the structure of genetic material.
 - Demonstrate techniques to observe the cell and its components under a microscope.
 - Discuss the basics of Mendelian genetics, its variations and interpret inheritance of traits in living beings.
 - Elucidate the role of extra-chromosomal genetic material for inheritance of characters.
 - Evaluate the structure, function and regulation of genetic material.
 - Understand the application of principles and modern techniques in plant breeding.
 - Explain the procedures of selection and hybridization for improvement of crops.
-

Unit – 1: The Cell

12 Hrs.

1. Cell theory; prokaryotic vs eukaryotic cell; animal vs plant cell; a brief account on ultra-structure of a plant cell.
2. Ultra-structure of cell wall.
3. Ultra-structure of plasma membrane and various theories on its organization.
4. Polymorphic cell organelles (Plastids); ultrastructure of chloroplast. Plastid DNA.

Unit – 2: Chromosomes

12 Hrs.

1. Prokaryotic vs eukaryotic chromosome. Morphology of a eukaryotic chromosome.
2. Euchromatin and Heterochromatin; Karyotype and ideogram.
3. Brief account of chromosomal aberrations - structural and numerical changes
4. Organization of DNA in a chromosome (solenoid and nucleosome models).

Unit – 3:Mendelian and Non-Mendelian genetics**14Hrs.**

1. Mendel's laws of inheritance. Incomplete dominance and co-dominance; Multiple allelism.
2. Complementary, supplementary and duplicate gene interactions (plant based examples are to be dealt).
3. A brief account of linkage and crossing over; Chromosomal mapping - 2 point and 3 point test cross.
4. Concept of maternal inheritance (Corren's experiment on *Mirabilis jalapa*); Mitochondrial DNA.

Unit – 4:Structure and functions of DNA**12 Hrs.**

1. Watson and Crick model of DNA. Brief account on DNA Replication (Semi-conservative method).
2. Brief account on Transcription, types and functions of RNA. Gene concept and genetic code and Translation.
3. Regulation of gene expression in prokaryotes - Lac Operon.

Unit – 5:Plant Breeding**12 Hrs.**

1. Plant Breeding and its scope; Genetic basis for plant breeding. Plant Introduction and acclimatization.
 2. Definition, procedure; applications and uses; advantages and limitations of :(a) Mass selection, (b) Pure line selection and (c) Clonal selection.
 3. Hybridization – schemes, and technique; Heterosis(hybrid vigour).
 4. A brief account on Molecular breeding – DNA markers in plant breeding. RAPD, RFLP.
-

Text books :

- Botany – III (Vrukshasastram-I) : Telugu Akademi, Hyderabad
- Pandey, B.P. (2013) *College Botany, Volume-III*, S. Chand Publishing, New Delhi
- Ghosh, A.K., K.Bhattacharya & G. Hait (2011) *A Text Book of Botany, Volume-III*, New Central Book Agency Pvt. Ltd., Kolkata
- Chaudhary, R. C. (1996) *Introduction to Plant Breeding*, Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi

Books for Reference:

- S. C. Rastogi (2008) *Cell Biology*, New Age International (P) Ltd. Publishers, New Delhi
- P. K. Gupta (2002) *Cell and Molecular biology*, Rastogi Publications, New Delhi
- B. D. Singh (2008) *Genetics*, Kalyani Publishers, Ludhiana
- A.V.S.S. Sambamurty (2007) *Molecular Genetics*, Narosa Publishing House, New Delhi
- Cooper, G.M. & R.E. Hausman (2009) *The Cell – A Molecular Approach*, A.S.M. Press, Washington
- Becker, W.M., L.J. Kleinsmith & J. Hardin (2007) *The World of Cell*, Pearson Education, Inc., New York
- De Robertis, E.D.P. & E.M.F. De Robertis Jr. (2002) *Cell and Molecular Biology*, Lippincott Williams & Wilkins Publ., Philadelphia
- Robert H. Tamarin (2002) *Principles of Genetics*, Tata McGraw –Hill Publishing Company Limited, New Delhi.
- Gardner, E.J., M. J. Simmons & D.P. Snustad (2004) *Principles of Genetics*, John Wiley & Sons Inc., New York
- Micklos, D.A., G.A. Freyer & D.A. Cotty (2005) *DNA Science: A First Course*, I.K. International Pvt. Ltd., New Delhi
- Chaudhari, H.K. (1983) *Elementary Principles of Plant Breeding*, TMH publishers Co., New Delhi
- Sharma, J.R. (1994) *Principles and Practice of Plant Breeding*, Tata McGraw- Hill Publishers, New Delhi
- Singh, B.D. (2001) *Plant Breeding : Principles and Methods*, Kalyani Publishers, Ludhiana

- Pundhan Singh (2015) *Plant Breeding for Undergraduate Students*, Kalyani Publishers, Ludhiana
- Gupta, S.K. (2010) *Plant Breeding : Theory and Techniques*, Agrobios (India), Jodhpur
- Hayes, H.K., F.R. Immer & D.C. Smith (2009) *Methods of Plant Breeding*, Biotech Books, Delhi

Practical Syllabus of Botany Core Course – 5/IVSemester

Cell Biology, Genetics and Plant Breeding

(Total hours of laboratory exercises 30 Hrs. @ 02 Hrs. /Week)

Course Outcomes: After successful completion of this practical course the student shall be able to:

1. Show the understanding of techniques of demonstrating Mitosis and Meiosis in the laboratory and identify different stages of cell division.
2. Identify and explain with diagram the cellular parts of a cell from a model or picture and prepare models
3. Solve the problems related to crosses and gene interactions.
4. Demonstrate plant breeding techniques such as emasculation and bagging

Practical Syllabus:

1. Study of ultra structure of plant cell and its organelles using Electron microscopic Photographs/models.
2. Demonstration of Mitosis in *Allium cepa*/*Aloe vera* roots using squash technique; observation of various stages of mitosis in permanent slides.
4. Demonstration of Meiosis in P.M.C.s of *Allium cepa* flower buds using squash technique; observation of various stages of meiosis in permanent slides.
4. Study of structure of DNA and RNA molecules using models.
5. Solving problems monohybrid, dihybrid, back and test crosses.
6. Solving problems on gene interactions (at least one problem for each of the gene interactions in the syllabus).
7. Chromosome mapping using 3- point test cross data.
8. Demonstration of emasculation, bagging, artificial pollination techniques for hybridization.

Model paper for Practical Examination

Semester-IV / Botany Core Course – 5

Cell Biology, Genetics and Plant Breeding

Max. Time: 3 Hrs.

Max. Marks: 50

1. Make a cytological preparation of given material 'A' (mitosis or meiosis in Onion) by squash technique, report any two stages, draw labeled diagrams and write the reasons.

15 M

2. Solve the given Genetic problem (Dihybrid cross/ Interaction of genes/ 3-point test cross) 'B' and write the conclusions.

15 M

3. Identify the following and justify with apt reasons.

3 x 4 = 12 M

C. Cell Biology (Cell organelle)

D. Genetics (DNA/RNA)

E. Plant Breeding

4. Record + Viva-voce

5 + 3 = 8 M

Suggested co-curricular activities for Botany Core Course- 5 in Semester-IV:

A. Measurable :

a. Student seminars :

1. Light microscopy : bright field and dark field microscopy.
2. Scanning Electron Microscopy (SEM).
3. Transmission Electron Microscopy (TEM).
4. Mitosis and Meiosis
5. Cell cycle and its regulation.
6. Cell organelles bounded by single membrane.
7. Prokaryotic chromosomes
8. Special types of chromosomes :Polytene, Lampbrush and B-chromosomes.
9. Different forms of DNA.
10. Gene mutations.
11. DNA damage and repair mechanisms.
12. Reverse transcription.
13. Protein structure.

14. Modes of reproduction in plants.

15. Modes of pollination in plants

b. Student Study Projects :

1. Study of mitotic cell cycle in roots of *Allium cepa*

2. Study of mitotic cell cycle in roots of *Aloe vera*

3. Observation of chromosomal aberrations in *Allium cepa* root cells exposed to industrial effluent(s).

4. Observation of chromosomal aberrations in *Allium cepa* root cells exposed to heavy metal(s).

5. Observation of polyembryony in *Citrus* spp. and *Mangifera indica*.

c. Assignments: Written assignment at home / during '0' hour at college; preparation of charts with drawings, making models etc., on topics included in syllabus.

B. General :

1. Field visit to Agriculture/Horticulture University/ Research station to observe Plant breeding methods.

2. Group Discussion (GD)/ Quiz/ Just A Minute (JAM) on different modules in syllabus of the course.

RECOMMENDED ASSESSMENT OF STUDENTS:

Recommended continuous assessment methods for all courses:

Some of the following suggested assessment methodologies could be adopted. Formal assessment for awarding marks for Internal Assessment in theory.

(a) Formal:

1. The oral and written examinations (Scheduled and surprise tests),
2. Simple, medium and Critical Assignments and Problem-solving exercises,
3. Practical assignments and laboratory reports,
4. Assessment of practical skills,
5. Individual and group project reports,
6. Seminar presentations,
7. Viva voce interviews.

(b) Informal:

1. Computerized adaptive testing, literature surveys and evaluations,
2. Peers and self-assessment, outputs from individual and collaborative work
3. Closed-book and open-book tests,

Common pattern for Question Paper for Theory Examination(s) at Semester end

Max. Time: 3 Hrs.

Max. Marks: 75 M

Section – A

Answer all the following questions.

5 x 2 = 10 M

- ✓ One question should be given from each Unit in the syllabus.

Section – B

Answer any three of the following questions. Draw a labeled diagram wherever necessary

3 x 5 = 15 M

- ✓ One question should be given from each Unit in the syllabus.

Section – C

Answer any five of the following questions. Draw a labeled diagram wherever necessary

5 x 10 = 50 M

- ✓ Two questions (a & b) are to be given from each Unit in the syllabus (internal choice in each unit). Student has to answer 5 questions by choosing one from a set of questions given from a Unit.

Note: Questions should be framed in such a way to test the understanding, analytical and creative skills of the students. All the questions should be given within the frame work of the syllabus prescribed.

Annexure

Objectives and General Outcomes of Programme and Domain Subject

Programme(B.Sc.) Objectives: The objectives of bachelor's degree programme with Botany are:

1. To provide a comprehensive knowledge on various aspects related to microbes and plants.
2. To deliver knowledge on latest developments in the field of Plant sciences with a practical approach.
3. To produce a student who thinks independently, critically and discuss various aspects of plant life.
4. To enable the graduate to prepare and pass through national and international examinations related to Botany.
5. To empower the student to become an employee or an entrepreneur in the field of Botany /Biology and to serve the nation.

Programme Outcomes:

1. Understand the basic concepts of Botany in relation to its allied core courses.
2. Perceive the significance of microbes and plants for human welfare, and structural and functional aspects of plants.
3. Demonstrate simple experiments related to plant sciences, analyze data, and interpret them with the theoretical knowledge.
4. Work in teams with enhanced inter-personal skills.
5. Develop the critical thinking with scientific temper.
6. Effectively communicate scientific ideas both orally and in writing.

Domain Subject(Botany) Objectives :

1. To impart knowledge on origin, evolution, structure, reproduction and interrelationships of microbes and early plant groups.
2. To provide knowledge on biology and taxonomy of true land plants within a phylogenetic framework.
3. To teach aspects related to anatomy, embryology and ecology of plants, and importance of Biodiversity.
4. To explain the structural and functional aspects of plants with respect to the cell organelles, chromosomes and genes, and methods of plant breeding.

5. To develop a critical understanding on SPAC, metabolism and growth and development in plants.
6. To enable the students proficient in experimental techniques and methods of analysis appropriate for various sub-courses in Botany.

Domain Subject(Botany) Outcomes:

1. Students will be able to identify, compare and distinguish various groups of microbes and primitive plants based on their characteristics.
2. Students will be able to explain the evolution of tracheophytes and also distribution of plants on globe.
3. Students will be able to discuss on internal structure, embryology and ecological adaptations of plants, and want of conserving Biodiversity.
4. Students will be able to interpret life processes in plants in relation to physiology and metabolism.
5. Students will be able to describe ultrastructure of plant cells, inheritance and crop improvement methods.
6. Students will independently design and conduct simple experiments based on the knowledge acquired in theory and practicals of the different sub-courses in Botany.

SUBJECT EXPERTS

Prof. C.Sudhakar
Dept of Botany,
Sri Krishnadevaraya University,
Anantapur

Dr.A.Srinivasa Rao
Lecturer in Botany,
Govt Degree College,
Mandapeta

SYLLABUS VETTED BY

Prof.M.Vijaya Lakshmi,
Dept of Botany and Microbiology,
Acharya Nagarjuna University,
Nagarjuna Nagar



ANDHRA PRADESH STATE COUNCIL OF HIGHER EDUCATION

(A Statutory body of the Government of Andhra Pradesh)

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SYLLABUS OF

ENVIRONMENTAL EDUCATION

AS PART OF LIFE SKILLS COURSES

UNDER CBCS FRAMEWORK WITH EFFECT FROM 2020-21

PROGRAMME: FOUR-YEAR UG HONOURS PROGRAMME

AP State Council of Higher Education

Revised Syllabus under CBCS Pattern

(w.e.f. 2020-'21 Academic Year)

A Mandatory Course for BA/BCom/BSc etc.

ENVIRONMENTAL EDUCATION

(Total hours of Teaching – 30 Hrs. @ 02 Hrs. per Week)

Course objective: A Generic Course intended to create awareness that the life of human beings is an integral part of environment and to inculcate the skills required to protect environment from all sides.

Learning outcomes: On completion of this course the students will be able to

1. Understand the nature, components of an ecosystem and that humans are an integral part of nature.
2. Realize the importance of environment, the goods and services of a healthy biodiversity, dependence of humans on environment.
3. Evaluate the ways and ill effects of destruction of environment, population explosion on ecosystems and global problems consequent to anthropogenic activities.
4. Discuss the laws/ acts made by government to prevent pollution, to protect biodiversity and environment as a whole.
5. Acquaint with international agreements and national movements, and realize citizen's role in protecting environment and nature.

Unit 1: Environment and Natural Resources

06 Hrs.

1. Multidisciplinary nature of environmental education; scope and importance.
2. Man as an integral product and part of the Nature.
3. A brief account of land, forest and water resources in India and their importance.

4. Biodiversity : Definition; importance of Biodiversity - ecological,consumptive, productive, social, ethical and moral, aesthetic, and option value.
5. Levels of Biodiversity: genetic, species and ecosystem diversity.

Unit-2: Environmental degradation and impacts

10Hrs

1. Human population growth and its impacts on environment; land use change, land degradation, soil erosion and desertification.
2. Use and over-exploitation of surface and ground water, construction of dams, floods, conflicts over water (within India).
3. Deforestation: Causes and effects due to expansion of agriculture, firewood, mining, forest fires and building of new habitats.
4. Non-renewable energy resources, their utilization and influences.
5. A brief account of air, water, soil and noise pollutions; Biological, industrial and solid wastes in urban areas. Human health and economic risks.
6. Green house effect - global warming; ocean acidification, ozone layer depletion, acid rains and impacts on human communities and agriculture.
7. Threats to biodiversity: Natural calamities, habitat destruction and fragmentation, over exploitation, hunting and poaching, introduction of exotic species, pollution, predator and pest control.

Unit 3: Conservation of Environment

10 Hrs

1. Concept of sustainability and sustainable development with judicious use of land, water and forest resources; afforestation.
2. Control measures for various types of pollution; use of renewable and alternate sources of energy.
3. Solid waste management: Control measures of urban and industrial waste.
4. Conservation of biodiversity: In-situ and ex-situ conservation of biodiversity.
5. Environment Laws: Environment Protection Act; Act; Wildlife Protection Act; Forest Conservation Act.
6. International agreements: Montreal and Kyoto protocols; Environmental movements: Bishnois of Rajasthan, Chipko, Silent valley.

Suggested activities to learner: (4 hours)

1. Visit to an area to document environmental assets: river/ forest/ flora/fauna, etc
2. Visit to a local polluted site-Urban/Rural/Industrial/Agricultural site.
3. Study of common plants, insects, birds and basic principles of identification.
4. Study of simple ecosystems-forest, tank, pond, lake, mangroves etc.
5. Case study of a Forest ecosystem or a pond ecosystem.

Suggested text book :

- ErachBarucha (2004) *Text book of Environmental Studies for Undergraduate courses* (Prepared for University Grants Commission) Universities Press.
- PurnimaSmarath (2018) *Environmental studies* Kalyani Publishers, Ludhiana

Reference books :

- Odum, E.P., Odum, H.T. & Andrews, J. (1971) *Fundamentals of Ecology*. Philadelphia: Saunders.
- Pepper, I.L., Gerba, C.P. & Brusseau, M.L. (2011). *Environmental and Pollution Science*. Academic Press.
- Raven, P.H., Hassenzahl, D.M. & Berg, L.R. (2012) *Environment. 8th edition*. John Wiley & Sons.
- Singh, J.S., Singh, S.P. and Gupta, S.R. (2014) *Ecology, Environmental Science and Conservation*. S. Chand Publishing, New Delhi.
- Sengupta, R. (2003) *Ecology and economics: An approach to sustainable development*. OUP.
- Wilson, E. O. (2006) *The Creation: An appeal to save life on earth*. New York: Norton.
- Groom, Martha J., Gary K. Meffe, and Carl Ronald Carroll (2006) *Principles of Conservation Biology*. Sunderland: Sinauer Associates,

**Model question paper for theory examination at the end of IV Semester
Life Skill Course / ENVIRONMENTAL SCIENCE**

Max. Time : 2 Hrs.

Max. Marks: 50

Max. Marks: 50 Time: 1 1/2 hrs (90 Minutes)

Section -A

(Total: 4x5=20 Marks)

(Answer any **four questions**. Each answer carries **5 marks**)

(Total 8 questions. At least 1 question should be given from each Unit)

- 1.
- 2.
- 3.
- 4.
- 5.
- 6.
- 7.
- 8.

Section- B

(Total: 3x10 = 30 Marks)

(Answer any **three questions**. Each answer carries **10 marks**)

(Total five questions. At least 1 question should be given from each Unit)

- 1.
- 2.
- 3.
- 4.
- 5.

Note: Questions may be set in such a way to test the outcomes instead of recalling of information.



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SYLLABUS OF

FRUITS AND VEGETABLE PRESERVATION

AS PART OF SKILL DEVELOPMENT COURSES

UNDER CBCS FRAMEWORK WITH EFFECT FROM 2020-21

PROGRAMME: FOUR-YEAR UG HONOURS PROGRAMME

A.P. STATE COUNCIL OF HIGHER EDUCATION

B.A, B.Com & B.Sc. PROGRAMMES

Revised CBCS w.e.f. 2020-21
SKILL DEVELOPMENT COURSES

Science Stream

Syllabus of
FRUITS AND VEGETABLES PRESERVATION

Total 30 hrs (02h/wk),

02 Credits & Max Marks: 50

Learning Outcomes:

On successful completion of this course the students will be able to;

- 1. Identify various types of fruits and vegetables and explain their nutritive value.*
- 2. Understand the fragile nature of fruits and vegetables and causes for their damage.*
- 3. Explain various methods of preservation for fresh fruits and vegetables.*
- 4. Get to know the value-added products made from fruits and vegetables.*

Syllabus:

Unit – 1 : Introduction to fruits and vegetables

06 Hrs.

1. Fruits: Definition, elementary knowledge on types of fruits (fleshy and dry) with local /common examples.
2. Vegetables: Definition, elementary knowledge on types of vegetables (root, leafy, stem, flower and fruit) with local/ common examples.
3. Importance of fruits and vegetables in human nutrition.
4. Concept of perishable plant products – maturation and spoilage, shelf life; preservation – definition and need for preservation of fruits and vegetables.

Unit – 2 :Preservation of Fruit

09 Hrs.

1. Fruits – ripening and biological aging; storage and preservation concerns.
2. Preservation of fresh fruits at room temperature and in cold storage.
3. Fruit preservation at room temperature as juices, squashes and syrups.
4. Preservation of fruits by application of heat; making of fruit products (jams, jellies and fruit slices in processing factories).
5. Preservation by dehydration (Eg. banana chips), application of sugar (Eg. mango candy), application of salt (pickling).
6. Fruit preservation by freezing – storage at the lowest temperatures.

Unit – 3 :Preservation of vegetables

09 Hrs.

1. Vegetables – losses after harvesting and causes; problems in handling and storage.
2. Modern methods of packaging and storage to reduce losses.
3. Trimming of vegetables and packing in cartons; dehydration technique -factory processing.
4. Making of vegetable products (flakes/chips of potato and onion; garlic powder).
5. Frozen vegetables – Carrots, Cauliflower, Okra and Spinach.
6. Preservation of sliced vegetables in factories by canning and bottling.
- 7.

Suggested Co-curricular activities (6 Hrs.)

1. Assignments/Group discussion/Quiz/Model Exam.
2. Invited lecture and demonstration by local expert
3. Exhibition of various types of locally available fruits and vegetables.
4. Hands on training on handling and packaging methods of fresh fruits and vegetables.
5. Hands on training on making fruit juices.
6. Display of various preserved fruit products available in local markets.
7. Hands on training on making of potato, yam, onion chips.
8. Display of various preserved vegetable products available in local markets.
9. Watching videos on preservation of fruits and vegetables.
10. Visit to Horticulture University or research station to learn about value added products of fruits and vegetables.

Suggested text books/reference books :

1. Giridharilal, G. S. Siddappa and G.L.Tandon(2007) *Preservation of Fruits and Vegetables*, Indian Council of Agri. Res., New Delhi
2. Srivastava, R.P., and Sanjeev Kumar (2019) *Fruit and Vegetable Preservation : Principles and Practices*, CBS Publishers & Distributors Pvt., Ltd., New Delhi
3. Thompson, A.K. (1995) *Post Harvest Technology of Fruits and Vegetables*. Blackwell Sci.,U.K.
4. Verma, L.R. and V.K. Joshi (2000) *Post Harvest Technology of Fruits and Vegetables*. Indus Publ., New Delhi

Recommended MODEL QUESTION PAPER FORMAT

Max. Marks: 50

Time: 1½ hrs (90 Minutes)

SECTION- A

(4x5M=20 Marks)

*Answer any four questions. Each answer carries 5 marks
(At least 1 question should be given from each Unit)*

1.	
2.	
3.	
4.	
5.	
6.	
7.	
8.	

SECTION B

(3x10M = 30 Marks)

*Answer any three questions. Each answer carries 10 marks
(At least 1 question should be given from each Unit)*

1.	
2.	
3.	
4.	
5.	



ANDHRA PRADESH STATE COUNCIL OF HIGHER EDUCATION

(A Statutory body of the Government of Andhra Pradesh)

3rd, 4th and 5th floors, Neeladri Towers, Sri Ram Nagar, 6th Battalion Road,
Atmakur (V), Mangalagiri(M), Guntur-522 503, Andhra Pradesh
Web: www.apsche.org **Email:** acapsche@gmail.com

SYLLABUS OF

PLANT NURSERY

**UNDER SKILL DEVELOPMENT COURSES
UNDER CBCS FRAMEWORK WITH EFFECT FROM 2020-21**

PROGRAMME: THREE-YEAR UG PROGRAMME

A.P. STATE COUNCIL OF HIGHER EDUCATION
B.A, B.Com & B.Sc. PROGRAMMES

Revised CBCS w.e.f. 2020-21
SKILL DEVELOPMENT COURSES
Science Stream

Syllabus of
PLANT NURSERY

Total 30 hrs (02h/wk),

02 Credits & Max Marks: 50

Learning Outcomes :

On successful completion of this course students will be able to;

- 1. Understand the importance of a plant nursery and basic infrastructure to establish it.*
- 2. Explain the basic material, tools and techniques required for nursery.*
- 3. Demonstrate expertise related to various practices in a nursery.*
- 4. Comprehend knowledge and skills to get an employment or to become an entrepreneur in plant nursery sector.*

Syllabus:

Unit-1 :Introduction to plant nursery

06 Hrs.

1. Plant nursery: Definition, importance.
2. Different types of nurseries –on the basis of duration, plants produced, structure used.
3. Basic facilities for a nursery; layout and components of a good nursery.
4. Plant propagation structures in brief.
5. Bureau of Indian Standards (BIS-2008) related to nursery.

Unit- 2 :Necessities for nursery

09 Hrs.

1. Nursery beds – types and precautions to be taken during preparation.
2. Growing media, nursery tools and implements, and containers for plant nursery, in brief.
3. Seeds and other vegetative material used to raise nursery. in brief.
4. Outlines of vegetative propagation techniques to produce planting material.
5. Sowing methods of seeds and planting material.

Unit-3 :Management of nursery

09 Hrs.

1. Seasonal activities and routine operations in a nursery.
2. Nursery management – watering, weeding and nutrients; pests and diseases.
3. Common possible errors in nursery activities.
4. Economics of nursery development, pricing and record maintenance.
5. Online nursery information and sales systems.

Suggested Co-curricular activities (6 Hrs.)

1. Assignments/Group discussion/Quiz/Model Exam.
2. Demonstration of nursery bed making.
3. Demonstration of preparation of media for nursery.
4. Hands on training on vegetative propagation techniques.
5. Hands on training on sowing methods of seeds and other material.
6. Invited lecture cum demonstration by local expert.
7. Watching videos on routine practices in plant nurseries.
8. Visit to an agriculture/horticulture /forest nursery.
9. Case study on establishment and success of a plant nursery.

Suggested text books/reference books :

1. Ratha Krishnan, M., et.al. (2014) *Plant nursery management : Principles and practices*, Central Arid Zone Research Institute (ICAR), Jodhpur, Rajasthan
2. Kumar, N., (1997) *Introduction to Horticulture*, Rajalakshmi Publications, Nagercoil.
3. KumarMishra, K., N.K. Mishra and Satish Chand (1994) *Plant Propagation*, John Wiley & Sons, New Jersey.

MODEL QUESTION PAPER

Max. Marks: 50

Time: 1½ hrs (90 Minutes)

SECTION- A

(4x5M=20 Marks)

*Answer any four questions. Each answer carries 5 marks
(At least 1 question should be given from each Unit)*

1.	
2.	
3.	
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8.	

SECTION B

(3x10M = 30 Marks)

*Answer any three questions. Each answer carries 10 marks
(At least 1 question should be given from each Unit)*

1.	
2.	
3.	
4.	
5.	

III B. Sc - SEMESTER- V: BOTANY SYLLABUS
THEORY PAPER – V

Paper-V: Cell Biology, Genetics and Plant Breeding

Total hours of teaching 60 hrs @ 3 hrs per week

UNIT – I Cell Biology:

(12hrs)

1. Cell, the unit of life- Cell theory, Prokaryotic and eukaryotic cells; Eukaryotic cell components.
2. Ultra structure and functions of cell wall and cell membranes.
3. Chromosomes: morphology, organization of DNA in a chromosome (nucleosome model), Euchromatin and heterochromatin.

UNIT – II Genetic Material:

(12hrs)

1. DNA as the genetic material: Griffith's and Avery's transformation experiment, Hershey – Chase bacteriophage experiment.
2. DNA structure (Watson & Crick model) and replication of DNA (semi-conservative)
3. Types of RNA (mRNA, tRNA, rRNA), their structure and function.

UNIT – III Mendelian Inheritance:

(12 hrs)

1. Mendel's laws of Inheritance (Mono- and Di- hybrid crosses); backcross and test cross.
2. Chromosome theory of Inheritance.
3. Linkage: concept, complete and incomplete linkage, coupling and repulsion; linkage maps based on two and three factor crosses.
4. Crossing Over: concept & significance.

UNIT – IV Plant Breeding:

(12 hrs)

1. Introduction and Objectives of plant breeding.
2. Methods of crop improvement: Procedure, advantages and limitations of Introduction, Selection, and Hybridization (outlines only).

UNIT – V Breeding, Crop Improvement and Biotechnology:

(12 hrs)

1. Role of mutations in crop improvement.
2. Role of somaclonal variations in crop improvement.
3. Molecular breeding – use of DNA markers in plant breeding and crop improvement (RAPD, RFLP).

Suggested activity: Seminar, Debate, Quiz, observation of live cells and nucleus in Onion peels, observation of Meiotic nuclei in Maize pollen. Solving Genetics problems.

Books for Reference:

1. Old, R.W. and Primrose S.B. 1994, Principles of Gene Manipulation Blackwell Science, London
2. Grierson, D. and Convey S.N. 1989, Plant Molecular Biology, Blackie Publishers, New York.
2. Lea, P.J. and Leegood R.C. 1999, Plant Biochemistry and Molecular Biology, John Wiley and Sons, London.
3. Power C.B., 1984, Cell Biology, Himalaya Publishing Co. Mumbai
4. De. Robertis and De Robertis, 1998, Cell and Moleceular Biology, K.M. Verghese and Company .
5. Sinnott, E.W., L.C. Dunn & J. Dobshansky (1958) : Principles of Genetics (5th Edition) McGraw Hill Publishing Co., N.Y. Toronto, London.
6. Winchester, A.M. (1958) : Genetics(3rd Edition) Oxford & IBH Publishing House, Calcutta, Bombay, New Delhi.
7. Singleton, R.(1963) : Elementary Genetics, D. Van Nostrand Co., Ltd., Inc., N.Y. & Affiliated East West Press (P) Ltd., New Delhi.
8. Strickberger, M.W. (1976): Genetics(2nd Edition) MacMillan Publishing Co., Inc., N.Y., London
9. Watson, J.D. (1977): Molecular Biology of the Gene, W.A. Benjamin, Inc., Menlo Park-California, Reading-Massachusetts, London, Amsterdam, Don Mills, Ontario, Sydney.
10. Gardner,E.J & Snusted, D.P.(1984): Principles of Genetics (7thedition) John Wiley & Sons, N.Y. Chichester, Brisbane, Toronto, Singapore.
11. Lewin, B. (1985) Genes VII Wiley Eastern Ltd., New Delhi, Bombay, Calcutta, Madras, Hydrabad.
12. Allard R.W(1999): The Principles of Plant Breeding, John & Wiley and Sons.
13. Poelman J.M: Breeding Field Crops, Springer.
14. George Acquaaah(2012):Principles of Plant Genetics & Breeding: Wiley-Blackwell.

III B. Sc - BOTANY SYLLABUS SEMESTER- V
Practical Paper-V: CELL BIOLOGY, GENETICS AND PLANT BREEDING
 Total hours of teaching 30hrs @ 2hrs per week

Suggested Laboratory Exercises:

1. Study of the structure of cell organelles through photomicrographs.
2. Study of structure of plant cell through temporary mounts.
3. Study of various stages of mitosis using cytological preparation of Onion root tips.
4. Study of DNA packing by micrographs.
5. Study of effect of temperature & organic solvent on permeability of cell membrane.
6. Numerical problems solving Mendel's Laws of inheritance
7. Chromosome mapping using 3 point test cross data.
8. Hybridization techniques – emasculation, bagging (for demonstration only).
9. Field visit to a plant breeding research station.
10. Calorimetric estimation of DNA by diphenylamine method.

III B. Sc – SEMESTER- V, BOTANY PRACTICAL MODEL PAPER
PAPER-V: CELL BIOLOGY, GENETICS AND PLANT BREEDING

- | | |
|--|-------------------|
| 1. Perform the Experiment A .Perform squash on onion root tip, prepare the slide, identify at least one division stage. Write the procedure and draw the diagram of reported stage. | 1 x 15 = 15marks |
| 2. Give the experimental protocol of the experiments B | 1 x 10 = 10 marks |
| 3. Solving numerical problems on Mendelian inheritance C,D | 2x7 1/2 =15 marks |
| 4. Record & Viva | = 10 marks |
| | ----- |
| | 50 marks |

A-Onion root squash technique

B- Estimation of DNA by diphenylamine method

C&D Numerical problems on Mendelian Inheritance.

III B. Sc - SEMESTER- V: BOTANY THEORY SYLLABUS
PAPER-VI: PLANT ECOLOGY & PHYTOGEOGRAPHY

Total hours of teaching 60 hrs @ 3 hrs per week

UNIT – I. Elements of Ecology (12 hrs)

1. Ecology: definition, branches and significance of ecology.
2. Climatic Factors: Light, Temperature, precipitation.
3. Edaphic Factor: Origin, formation, composition and soil profile.
4. Biotic Factor: Interactions between plants and animals.

UNIT– II. Ecosystem Ecology (12 hrs)

1. Ecosystem: Concept and components, energy flow, Food chain, Food web, Ecological pyramids.
2. Productivity of ecosystem-Primary, Secondary and Net productivity.
3. Biogeochemical cycles- Carbon, Nitrogen and Phosphorous.

UNIT – II Population & Community Ecology (12 hrs)

1. Population -definition, characteristics and importance, outlines –ecotypes.
2. Plant communities- characters of a community, outlines – Frequency, density, cover, life forms, competition.
3. Interaction between plants growing in a community.

UNIT – IV Phytogeography (12 hrs)

1. Principles of Phytogeography, Distribution (wides, endemic, discontinuous species)
2. Phytogeographic regions of India.
3. Phytogeographic regions of World.
4. Endemism – types and causes

UNIT- V: Plant Biodiversity and its importance (12 hrs)

1. Definition, levels of biodiversity-genetic, species and ecosystem.
2. Biodiversity hotspots- Criteria, Biodiversity hotspots of India.
3. Loss of biodiversity – causes and conservation (*In-situ* and *ex-situ* methods).
4. Seed banks - conservation of genetic resources and their importance

Suggested activity :Collection of different soils, studying their texture, observing polluted water bodies, student study projects, debates on man's activity on ecosystem and biodiversity conservation methods, visiting a nearest natural vegetation area. Visit to NGO, working in the field of biodiversity and report writing; to study Honey Bees and plants yielding honey.

Books for Reference:

1. Daubenmire, R.F. (): Plants & Environment (2nd Edn.,) John Wiley & Sons., New York
2. Puri, .G.S. (1960): Indian Forest Ecology (Vol.I & II) Oxford Book Co., New Delhi & Calcutta.
3. Billings, W.B. (1965): Plants and the Ecosystem Wadsworth Publishing Co., Inc., Belmont.
4. Misra, R. (1968): The Ecology work Book Oxford & INH Publishing Co., Calcutta
5. Odum E.P. (1971): Fundamentals of Ecology (2nd Edn.,) Saunders & Co., Philadelphia & Natraj Publishers, Dehradun.
6. Odum E.P. (1975): Ecology By Holt, Rinert & Winston.
7. Oosting, H.G. (1978): Plants and Ecosystem Wadworth Belmont.
8. Kochhar, P.L. (1975): Plant Ecology. (9th Edn.,) New Delhi, Bombay, Calcutta-226pp.,
9. Kumar, H.D. (1992): Modern Concepts of Ecology (7th Edn.,) Vikas Publishing Co., New Delhi.
10. Kumar H.D. (2000): Biodiversity & Sustainable Conservation Oxford & IBH Publishing 10. Co Ltd. New Delhi.
11. Newman, E.I. (2000): Applied Ecology Blackwell Scientific Publisher, U.K.
12. Chapman, J.L&M.J. Reiss (1992): ecology (Principles & Applications). Cambridge University Press, U.K.
13. Cain, S.A . (1944): Foundations of Plant Geography Harper & Brothers, N.Y.
14. Mani, M.S (1974): Ecology & Biogeography of India Dr. W. Junk Publishers, The Haque
15. Good, R. (1997): The Geography of flowering Plants (2nd Edn.) Longmans, Green & Co., Inc., London & Allied Science Publishers, New Delhi

**III B. Sc - SEMESTER- V: BOTANY PRACTICAL
PRACTICAL PAPER-VI: PLANT ECOLOGY & PHYTOGEOGRAPHY**

Total hours of teaching 30 hrs @ 3 hrs per week

1. Study of instruments used to measure microclimatic variables; soil thermometer, maximum and minimum thermometer, anemometer, psychrometer, rain gauge, and lux meter.
2. Permeability (percolation; total capacity as well as rate of movement) of different soil samples.
3. Determination of soil pH
4. Study of morphological and anatomical adaptations of hydrophytes and xerophytes (4 each)
5. Determination of minimal quadrat size for the study of herbaceous vegetation in the college campus by species area curve method
6. Study of Phytoplankton and macrophytes from water bodies.
 6. Study of species diversity index of vegetation.
7. Estimation of Primary Productivity of an ecosystem
8. To study field vegetation with respect to stratification, canopy cover and composition.
9. Study of plants included in agro forestry and social forestry.
10. To locate the hotspots, phyto geographical regions and distribution of endemic plants in the map of India.
11. The following practical should be conducted in the Field/lab with the help of photographs, herbarium, Floras, Red data book- Study of endangered plants species, critically endangered plants species, vulnerable plant species and monotypic endemic genera of India.

**III B. Sc - SEMESTER- V: BOTANY PRACTICAL MODEL PAPER
PAPER–VI: PLANT ECOLOGY & PHYTOGEOGRAPHY**

1. Study Project under supervision	=	15 Marks
2. Record & Viva-Voce	=	10 Marks
3. Experiment A	=	10 Marks
4. Anatomical adaptations of B (Section cutting)	=	10 Marks
5. Spotters C&D (2x2 1/2)	=	5 Marks

Total =		50 Marks

1. Study Project of a surrounding Ecosystem (terrestrial or aquatic)(plant diversity, animal diversity, human activity, pollution levels, restoration efforts under supervision.
2. Presentation of the project work in Q & A session.
3. **A** -determination of soil porosity/PH/percolation/retaining capacity.
4. **B**- Xerophyte/Hydrophyte anatomical adaptations.
5. **C & D**-anemometer/rain gauze/lux meter.

BOTANY

Model Theory Question Paper

III B.Sc SEMESTER -V

Paper -V (Cell Biology, Genetics and Plant Breeding)

Time : 3 Hrs

Max.Marks : 75 Marks

Section- A : సెక్షన్: ఏ

5x5=25 Marks

Answer any five of the following:

Draw neat and labeled diagrams wherever necessary.

ఏ ఐదోనైనా సరే ప్రశ్నలకు జవాబులు వ్రాయండి.

1. Enumerate Eukaryotic cell Components.

నిజజీవకణ కణము యొక్క కణాంకాలను గుర్తించండి.

2. Write Short notes on types of Chromosomes.

వివిధ రకాల క్రోమోజోమ్లను గుర్తించి వాటి ప్రయోజనం వ్రాయండి.

3. Write about the structure and function of m-R.N.A.

m-R.N.A. నిర్మాణము, విధులను గుర్తించండి.

4. Discuss about the Griffith and Avery Experiment.

గ్రీఫిత్ మరియు ఆవేరి ప్రయోగమును గుర్తించండి.

5. Test cross : పరీక్షా సంకరణము

6. Complete Linkage : సంపూర్ణ సహ లక్షణం

7. Plant Hybridization : మేలికా ప్రభుత్వము

8. Molecular Plant Breeding : అణు ప్రభుత్వము

K. Sujatha
Dr. K. Sujatha
BOS chair person

1. G. S. S. S.
(D. HOVINDARASULU)
BOS member

2. B. Lakshmi
Dr. B. Lakshmi
B.O.S. member

Section-B

5x10=50 Marks

Answer all Questions:

Draw neat and labeled diagrams wherever necessary.

అన్ని ప్రశ్నలను సమాధానములు అయియు
అవసరమైనచోట పటములు గీయు.

9.(a) Write an essay on structure and function of Plasma membrane.

ప్లాస్మా కేవలము, నిర్మాణము లిధులను గూర్చి అయింది

(or)

(b) Describe the Ultra structure of Chromosomes.

క్రోమోజోముల సూక్ష్మ నిర్మాణమును వర్ణించండి.

10.(a) Describe Hershey- Chase Bacteria Phage Experiment.

హెర్షీ- చౌజ్ బాక్టీరియా ఫేజ్ ప్రయోగమును వర్ణించండి

(or)

(b) Write an essay on DNA replication.

D. N. A. ప్రతికృతిని గూర్చి అయింది.

11.(a) Discuss about Chromosomal theory of Inheritance.

క్రోమోజోముల అనువంశికత సిద్ధాంతమును గూర్చి వర్ణించండి.

(or)

(b) Write about Crossing over Concept and its Significance.

పాకేజి సిద్ధాంత భావన మరియు ప్రాముఖ్యతను వర్ణించండి.

1. 


(D. GOVINDARATU)

BOS member

2. 

DR. B. LAKSHMI

BOS member


Dr. K. Sujatha
BOS chairperson

12.(a) Write an essay on objectives of Plant Breeding.

వృక్ష ప్రజనన ముఖ్య లక్ష్యాలను గుర్తించి వ్యాసము వ్రాయండి.

(or)

(b) Describe about advantages and limitations of Plant Selection.

మొక్కల ఎంపికకు ఉత్తమ ప్రయోజనాలు మరియు పరిమితులను గుర్తింపండి.

13.(a) Explain the role of Mutations in Crop-Improvement.

పంటల అభివృద్ధిలో ఉత్పత్తి వర్తనాల యొక్క పాత్రను వివరించండి.

(or)

(b) Describe the uses of DNA markers in Plant Breeding.

వృక్ష ప్రజననములో DNA మార్కర్ల పాత్రను వివరించండి.

K. Sujatha
Dr. K. Sujatha
BOS chairperson.

1. అనుకు

(D. HOUINDA R. ATULU)

BOS member

2. B. Lakshmi

Dr. B. LAKSHMI

BOS member

BOTANY

Model Theory Question Paper

III B.Sc SEMESTER -V

Paper -VI (Plant Ecology & Phyto Geography)

Time : 3 Hrs

Max.Marks : 75 Marks

Section- A

5x5=25 Marks

Answer any five of the following:

Draw neat and labeled diagrams wherever necessary.

: ఏ వేని ఇనుకొనలకు సమాధానములు
అవసరమైతే పడయాలి గారు.

1. Origin of soil : మృత్తిక ఆవిర్భావము.
2. Food Chain : ఆహార శ్రేణి నామము.
3. Significance of Ecology : ఆరణ్య శాస్త్ర ప్రాముఖ్యత.
4. Ecotype : ఔషధ ఔషధము.
5. Energy Flow : శక్తి ప్రవాహము.
6. Plant Distribution : మొక్కల పంపిణీ.
7. In-Situ Conservation : స్థానిక సంరక్షణ.
8. Net Productivity : నికర ఉత్పత్తి.

K. Sujatha
Dr. K. Sujatha
BOS Chairperson

1. D. Iyengar
(D. IYENGAR)

BOS member
2. B. Lakshmi
Dr. B. Lakshmi
B-O-S. member

Section-B

5x10=50 Marks

Answer all Questions:

Draw neat and labeled diagrams wherever necessary.

1. దేవుని ప్రశ్నలకు సమాధానములు వ్రాయండి.
అవసరమైన చిత్రాలను వ్రాయండి.

9. (a) Describe the role of Temperature and Light in Ecology.

అవరణ శాస్త్రములో ఉష్ణం మరియు కాంతి పాత్రను వర్ణించండి.

(Or)

(b) Discuss about the interactions between Plants and Animals in Ecology.

అవరణ శాస్త్రములో మొక్కలు మరియు జంతువుల మధ్య సంబంధాలను వివరించండి.

10. (a) Explain the significance of Ecological Pyramids.

ఇక్కడ లక్షకక పిరమిడ్ల ప్రాముఖ్యతను వివరించండి.

(Or)

(b) Write an essay on Nitrogen Cycle.

నత్రజన చలనము గురించి వ్యాసము వ్రాయండి.

11. (a) Describe the role of Plant Communities in Ecology.


అవరణ శాస్త్రములో వృక్ష సంఘాల పాత్రను సూక్ష్మ వర్ణించండి.


(Or)

(b) Write about the importance of Plant Population.

వృక్ష జనాభా యొక్క ప్రాముఖ్యతను వివరించండి.

K. Sujatha
Dr. K. Sujatha
BOS Chairperson

1. 
C.D. GOVINDARAJULU
BOS member

2. 
Dr. B. LAKSHMI
B.O.S. member

