ADUSUMILLI GOPALAKRISHNAIAH & SUGAR CANE GROWERS SIDDHARTHA DEGREE COLLEGE OF ARTS & SCIENCE, VUYYURU-521165, KRISHNA Dt., A.P. (AUTONOMOUS).

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DEPARTMENT OF BOTANY

BOS MEETING 13 - 10 -2023

ACADEMIC YEAR - (2023-24)

ODD SEM – I, III &V

ADUSUMILLI GOPALAKRISHNAIAH & SUGAR CANE GROWERS SIDDHARTHA DEGREE COLLEGE OF ARTS & SCIENCE, VUYYURU-521165, KRISHNA Dt., A.P. (AUTONOMOUS).
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DEPARTMENT OF BOTANY
BOARD OF STUDIES MEETING: **13th October 2023**

The Board of studies meeting of Department of Botany was convened at **11:00A.M on 13/10/2023** under the chairmanship of Smt. Ch.Beulah Ranjani Head of the Department .The members present have discussed various aspects such as changes to be made in the syllabi, scheme of Evaluation and Blue print both for theory and practical papers, Departmental activities for 2023-2024, Estimated Budget proposals 2022-2023 for implementing them effectively during the I, III & V/VI semesters for the academic year 2023-2024 onwards.

The following members were present.

S.No	Name	Designation	signature
1.	**Smt. Ch. Beulah Ranjani** Head, Department of Botany A.G&S.G.S Degree College Vuyyuru.	Chair person	Ch. B. Ranjani
2	**prof. Avasan Maruthi** Bio Sciences & Bio technology Krishna University Machilipatnam.	University Nominee	
3.	**Sri Dr. Ch. Srinivasa Reddy** Lecturer in Botany SRR & CVR Govt. Degree College, Vijayawada.	Subject Expert	Ch Srinivasa Reddy
4.	**P. Srinivasa Rao** Department of Botany, P.B. Siddhartha College,	Subject Expert	P. Srinivasa Rao 13/10/23.
5.	**Sri. S. Krishna Suman,** Natural farmer, yakamuru Vuyyuru.	Industrialist	S. Krishna Suman.
6.	**Sri. N. Ramana Rao** Lecturer in Botany, A.G &S.G.S Degree College Vuyyuru.	Member	N. Ramana Rao
7.	**Mr. M.T.V.Mahesh.** (P.G Chemistry) A.G &S.G.S Degree College Vuyyuru	Student Represent	M. T. V. Mahesh

BOTANY

Agenda for B.O .S Meeting.

1. To recommend the syllabi (Theory & Practical) for First Semester of **I B.Sc. Botany Major of B.Sc. Honours** for the academic year 2023 -2024 as prescribed by APSCHE.

2. To recommend the Model Question paper, Blue Print and Guidelines for Question paper setters for First Semester of **I B.Sc. Botany Major of B.Sc. Honours** for the academic year 2023 – 2024

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3. To recommend the syllabi (Theory & Practical), Model question paper, Blue Print and Guidelines for Question paper setters for III Semester of II B.Sc. (B.Z.C& ABC) for the academic year 2023 - 2024.

4. To recommend the syllabi (Theory & Practical), Model question paper, Blue Print and Guidelines for Question paper setters for V Semester of III B.Sc. (B.Z.C& ABC) for the academic year 2023 - 2024.

5. To introduce Value Added Course (Non-Credits) on Hydroponics for III Semester of II B.Sc.(B.Z.C & ABC) for the academic year 2023 - 2024.

6. To recommend the teaching and evaluation methods to be followed under Autonomous status.

7. Any other matter.

CH. Beulah Ranjani

Chairman

RESOLUTIONS:

1. It is resolved to implement the syllabi prescribed by APSCHE for First Semester of **I B.Sc. Botany Major of B.Sc. Honors for** the academic year 2023-2024 without any changes.

2. It is resolved to Conform to the question paper format in accordance with APSCHE norms. Starting from the academic year 2023 - 24, both internal and external exams conducted by the department will feature objective type questions, replacing descriptive questions aligning with APSCHE guidelines.

3. It is resolved to continue the same syllabus (Theory & Practical), Model question paper, Blue Print and Guidelines for Question paper setters for V Semester of III B.Sc. (B.Z.C& ABC) for the academic year 2023- 2024.

4. It is resolved to introduce Value Added Course (Non-Credits) on Hydroponics for III Semester of II B.Sc.(B.Z.C& ABC) for the academic year 2023 - 2024.
5. It is resolved to implement the following Teaching and Evaluation methods to be followed under Autonomous status.

Evaluation procedure:

Internal Assessment Examination :

- Out of maximum 100 marks in each paper for I B.Sc. **Botany** Major of B. Sc. Honours 30 marks are allocated for internal assessment.
- Out of these 30 marks, 20 marks are allocated for Announced tests (IA-1& IA-2). Two announced tests will be conducted and average of these two tests shall be deemed as the marks obtained by the student, 5 marks are allocated on the basis of candidate's percentage of attendance and remaining 5 marks are allocated for the assignment/activity.
- Out of maximum 100 marks in each paper for III Semester of II B.Sc, BZC& ABC 30 marks shall be allocated for internal assessment.
- Out of these 30 marks, 20 marks are allocated for announced tests (IA-1& IA-2). Two announced tests will be conducted and average of these two tests shall be deemed as the marks obtained by the student, 5 marks allocated on assignment and reaming 5 marks seminar for III semester. There is no pass minimum for internal assessment for III Semester.
- Out of maximum 100 marks in each paper for V Semester of III B.Sc. BZC& ABC 30 marks shall be allocated for internal assessment.
- Out of these 25 marks, 15 marks are allocated for announced tests (IA-1& IA-2). Two announced tests will be conducted and average of these two tests shall be deemed as the marks obtained by the student, 5 marks allocated on assignment and reaming 5 marks seminar for V semester. There is no pass minimum for internal assessment for V Semester .

- Semester – End Examination:
- The maximum mark for I semester – End examination shall be 70 marks and duration of the examination shall be 3 hours.
- 70 marks are allocated for I Semester of First B.Sc. **Botany** Major of B. Sc. Honours in Semester end Examination. Even through the candidate is absent for two IA exams / obtain zero marks the external marks are considered (if the candidate gets 40/70) and the result shall be declared as "PASS"
- 70 marks are allocated for III Semester of second B.Sc. BZC& ABC in Semester End Examination. Even through the candidate is absent for two IA exams / obtain zero marks the external marks are considered (if the candidate gets 40/70) and the result shall be declared as "PASS".

- 75 marks are allocated for V Semester of III B.Sc. BZC& ABC and V/ VI semesters of III B.Sc. BZC& ABC in Semester End Examination. Even through the candidate is absent for two IA exams / obtain zero marks the external marks are considered (if the candidate gets 40/75) and the result shall be declared as "PASS.

CH. Beulah Ranjani

Chairman

ADUSUMILLIGOPALAKRISHNAIAH& SUGAR CANE GROWERS SIDDHARTHA DEGREE COLLEGE OF ARTS & SCIENCE, VUYYURU (AUTONOMOUS)

COURSE STRUCTURE – 2023 -2024

Semester	Course Code	Course Title	Hours/ Week	CIA	SEE	No.of Credits	Core/LSC/ SDC/MDC Elective/ Cluster
I	23CBLT01	Classical Biology	4	30	70	3	Core
	23CBLP01	Classical Biology Activity	2	5	-	2	Lab
II	23ABLT01	Applied Biology	4	30	70	3	Core
	23ABLP01	Applied Biology Activity	2	5	-	2	Lab
III	BOTT31A	Anatomy and Embryology of Angiosperms, Plant Ecology and Biodiversity.	4	30	70	4	Core
	BOTT31A	Practical	2	10	40	2	Lab
V	SECBOTT01	Plant tissue culture	3	25	75	3	Core
	SECBOTT02	Practical	3	10	40	3	Lab
V	SECBOTT02	Mushroom cultivation	3	25	75	3	Core
	SECBOTT01	Practical	3	10	40	3	Lab
III	BOTVAC-03	Hydroponics	-	-	-	-	Value added course

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Botany Honours

Title of the Paper: **Introduction to classical biology**

Semester: - I

Course Code	23CBLTO1	Course Delivery Method	Class Room/Blended Mode - Both
Credits	4	CIA Marks	30
No. of Lecture Hours/ Week	5	Semester End Exam Marks	70
Total Number of Lecture Hours	60	Total Marks	100
Year of Introduction : 2023-2024	Year of Offering 2023-2024	Year of Revision –	Percentage of Revision: 0%

Course Prerequisites:

Learning objectives

The student will be able to learn the diversity and classification of living organisms and understand their chemical, cytological, evolutionary and genetic principles.

Course Objectives:

CO: 1	Learn the principles of classification and preservation of biodiversity
CO: 2	Understand the plant anatomical, physiological and reproductive processes
CO: 3	Knowledge on animal classification, physiology, embryonic development and their economic importance
CO: 4	Outline the cell components, cell processes like cell division, heredity and molecular processes.
CO: 5	Comprehend the chemical principles in shaping and driving the macromolecules and life processes.

Syllabus

Course Details

Unit	Learning Units	Hours
I	**Unit1: Introduction to systematic, taxonomy and ecology.** Systematics –Definition and concept, Taxonomy– Definition and hierarchy. Nomenclature–ICBN and ICZN, Binomial and trinomial nomenclature. Ecology – Concept of ecosystem**,(**Structure and function-outlines) Biodiversity and conservation.(Value of Biodiversity and types of conservation) Pollution and climate change. (Causes, effects of air, water and soil pollution, ozone depletion, acid rain, greenhouse gases, global warming.	12 HRS
II	**Unit2: Essentials of Botany.** The classification of plant kingdom**.** (2Whittaker Classification of Planate) Plant physiological processes (Photosynthesis- light &dark reactions, Respiration (- glycolysis ,link reaction, Krebs cycle& oxidative phosphorylation, Transpiration- types ,stomatal complex, mechanism of stomatal movement based on K+ ion movement) , phytohormones - Role of Auxins, Gibberellins, Cytokinins, Abscissic acid ,Ethylene). Structure of flower–Micro and macro sporogenesis, pollination- (types& agents), fertilization and structure of mono and dicot embryos. Mushroom cultivation, oyster floriculture (of local flowers) and landscaping. (Principles)	15HRS
III	**Essentials of zoology :** Broad classification of Kingdom Animalia up to phyla. Animal Physiology – Basics of Organ Systems and their functions, Hormones and Disorders. Developmental Biology – Gameto genesis, Fertilization, Cleavage and Organogenesis (Basic concepts) Economic Zoology – Sericulture, Apiculture, Aquaculture (Concepts and Economic Importance.)	12 HRS
IV	**Evolution, Cell Biology and Genetics:** **Origin of life** Cell theory , Ultra structure of prokaryotic and eukaryotic cell, cell cycle (Outlines only) Chromosomes and heredity – Structure of chromosomes, concept of gene. Central Dogma of Molecular Biology (Outlines of transcription and translation, Role of genetic code)	12 HRS
V	**Essentials of chemistry:** Definition and scope of chemistry, applications of chemistry in daily life (Chemistry in food, Agriculture, Hygiene, Cosmetics, and Textiles & Building construction). Branches of chemistry (Inorganic, Organic ,Physical , Analytical and Industrial chemistry) Chemical bonds- ionic, covalent, non – covalent – Vander Waals, hydrophobic, hydrogen bonds. Green chemistry	09 HRS

References

1. Sharma O.P., 1993.Plant taxonomy.2nd Edition.McGraw Hill publishers.
2. PandeyB.P. 2001. The text book of botany Angiosperms. 4th edition. S.Chand publishers, New Delhi, India.
3. Jordan E.L., Verma P.S.,2018. Chordate Zoology. Scand publishers, New Delhi, India.
4. Restage, S.C., 2019. Essentials of animal physiology. 4th Edition. New Age International Publishers.
5. Verma P.S., Agarwal V.K., 2006. Cell biology, genetics, Molecular Biology, Evolution and Ecology. S. Chan publishers, New Delhi, India.
6. Satyanarayana U., Chakrapani, U., 2013.Biochemistry. 4th Edition. Elsevier publishers.
7. JainJ.L., SunjayJain,NitinJain,2000.Fundamental soft Biochemistry .S.Chand publishers, New Delhi,India.
8. Karen Timber lake, William Timber lake, 2019. Basic chemistry. 5th Edition. Pearson publishers.
9. Subrata Sen Gupta,2014. Organic chemistry.1st Edition.Oxford publishers.

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ACTIVITIES- I (At the end of I Semester)

Title of the paper: Introduction to Classical Biology

No of Hours: 30
WEF: 2023-2024 **Course Code:** 23CBLP01

ACTIVITIES:

1. Make a display chart of life cycle of non flowering plants.
2. Make a display chart of life cycle of flowering plants.
3. Study of stomata
4. Activity to prove that chlorophyll is essential for photo synthesis
5. Study of pollen grains.
6. Observation of pollen germination.
7. Ikebana.
8. Differentiate between edible and poisonous mushrooms.
9. Visit a near by mushroom cultivation unit and know the economic soft mushroom cultivation.
10. Draw the Ultra structure of Prokaryotic and Eukaryotic Cell
11. Visit to Zoology Lab and observe different types of preservation of specimens
12. Hands-on experience of various equipment – Microscopes, Centrifuge, pH Meter, Electronic Weighing Balance, Laminar Air Flow
13. Visit to Zoo/Sericulture / Apiculture/ Aquaculture unit
14. List out different hormonal, genetic and physiological disorders from the society

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Title of the Paper: **Introduction to Applied Biology**

Semester: - I

Course Code	**23ABLT01**	Course Delivery Method	Class Room/Blended Mode - Both
Credits	4	CIA Marks	30
No. of Lecture Hours/ Week	5	Semester End Exam Marks	70
Total Number of Lecture Hours	60	Total Marks	100
Year of Introduction : 2023-2024	Year of Offering 2023-2024	Year of Revision –	Percentage of Revision: 0%

Learning objectives

The student will be able to learn the foundations and principles of microbiology, immunology, biochemistry, biotechnology, analytical tools, quantitative methods, and bioinformatics.

Learning Outcomes:

CO: 1	Learn the history, ultra structure, diversity and importance of microorganisms.
CO: 2	Understand the structure and functions of macromolecules
CO: 3	Knowledge on biotechnology principles and its applications in food and medicine
CO: 4	Outline the techniques, tools and their uses in diagnosis and therapy
CO: 5	Demonstrate the bioinformatics and statistical tools in comprehending the complex biological data.

Unit	Learning Units	Lecture Hours
I	**Essentials of Microbiology and Immunology** History and Major Milestones of Microbiology, Contributions of LouisPasteur, Robert Koch, Edward Jenner and Joseph Lister. Structure and characteristics of Bacteria, Fungi, Archaea andViruses. Applications of microorganisms in Food, Agriculture, Environment and Industry. Immune system – Types of immunity (Innate and Acquired), Cells and organs of immune system.	12 HRS
II	**Essentials of Biochemistry** Bio molecules I – Carbohydrates, Lipids (General Structure, classification and Biological importance). Bio molecules II – Amino acids (General Structure, classification- Essential and Non- Essential and Biological importance), Proteins(General Structure, classification and Biological importance) Bio molecules III – Nucleic acids - DNA and RNA (Structure, Types and Biological importance) Basics of Metabolism – Anabolism and catabolism (Definition and examples).	12 HRS
III	**Essentials of Biotechnology** History, scope and significance of Bio technology- Applications of Biotechnology in Plant, Animal Industrial and Pharmaceutical sciences. Environmental Biotechnology – Bio remediation and Bio fuels, Bio fertilizers and Bio pesticides. (Definitions and common examples) Genetic engineering – Gene manipulation using restriction enzymes and cloning vectors- P^{BR322}, λ phage. Methods of Gene transfer- Physical- Electro poration, chemical- PEG, and Biological- Transduction. Transgenic plants – Stress tolerant plants (biotic stress – BT cotton, abiotic stress – salttolerance). Transgenic animals – Animal (Fish) and disease models.(Mouse)	12 HRS
IV	**Analytical Tools and techniques in biology – Applications** Applications in forensics – PCR and DNA fingerprinting (Concept and application) Immunological techniques – Immuno blotting and ELISA. (Concept and application) Monoclonal antibodies – Applications in diagnosis and therapy. Eugenics and Gene therapy (Definition and examples).	12 HRS
V	**Biostatistics and Bioinformatics** Data collection and sampling. Measures of central tendency – Mean, Median, Mode. Measures of dispersion – range, standard deviation and variance. Probability and tests of significance- t- test Introduction, Genomics, Proteomics, types of Biological data, Biological databases- NCBI,EBI, Gen Bank; Protein 3D structures, Sequence alignment. Accessing Nucleic Acid and Protein databases, NCBI Genome Workbench.	12 HRS

REFERENCES

1. Gerard J., Tortora, Berdell R. Funke, Christine L. Case., 2016. Microbiology: An Introduction. 11th Edition. Pearson publications, London, England.
2. Micale, J. Pelczar Jr., E.C.S. Chan., Noel R. Kraig., 2002. Pelczar Microbiology. 5th Edition. McGraw Education, New York, USA.
3. Sathyanarayana U., Chakrapani, U., 2013. Biochemistry. 4th Edition. Elsevier publishers.
4. Jain J.L., Sunjay Jain, Nitin Jain, 2000. Fundamentals of Biochemistry. S. Chand publishers, New Delhi, India.
5. R.C. Dubey, 2014. Advanced Biotechnology. S. Chand Publishers, New Delhi, India.
6. Colin Ratledge, Bjorn, Kristiansen, 2008. Basic Biotechnology. 3rd Edition. Cambridge Publishers.
7. U. Sathyanarayana, 2005. Biotechnology. 1st Edition. Books and Allied Publishers pvt. ltd., Kolkata.
8. Upadhyay, Upadhyay and Nath. 2016. Biophysical Chemistry, Principles and Techniques. Himalaya Publishing House.
9. Arthur M. Lesk. Introduction to Bioinformatics. 5th Edition. Oxford publishers.
10. AP Kulkarni, 2020. Basics of Biostatistics. 2nd Edition. CBS publishers.

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ACTIVITIES- I (At the end of I Semester)

Title of the paper: Introduction to Applied Biology

No of Hours: 30
WEF: 2023-2024 Course Code: 23ABLP01

ACTIVITIES

1. Identification of given organism as harmful or beneficial.
2. Observation of microorganisms from house dust under microscope.
3. Finding microorganism from pond water.
4. Visit to a microbiology industry or biotech company.
5. Visit to a waste water treatment plant.
6. Retrieving a DNA or protein sequence of a gene'
7. Performing a BLAST analysis for DNA and protein.
8. Problems on biostatistics.
9. Field trip and awareness programs on environmental pollution by different types of wastes and hazardous materials.
10. Demonstration on basic biotechnology lab equipment.
11. Preparation of 3D models of genetic engineering techniques.
12. Preparation of 3D models of transgenic plants and animals.

[**NOTE**: In the colleges where there is availability of faculty for microbiology and biotechnology, those chapters need to be handled by microbiology and biotechnology faculty. In other colleges, the above topics shall be dealt by Botany and Zoology faculty]

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Title of the Paper: **(Anatomy and Embryology of Angiosperms, Plant Ecology and Biodiversity)**

Semester: - III

Course Code	BOTT31A	Course Delivery Method	Class Room/Blended Mode - Both
Credits	4	CIA Marks	30
No. of Lecture Hours/ Week	4	Semester End Exam Marks	70
Total Number of Lecture Hours	60	Total Marks	100
Year of Introduction : 2021-22	Year of Offering 2021-2022	Year of Revision –2023-24	Percentage of Revision: 0%

Course Prerequisites: Knowledge of Anatomy and Embryology of angiosperms, Plant Ecology and Biodiversity at +2 level.

Course Description: This course will provide one with a basic and comprehensive understanding of anatomical structure and functions. Enable the student with depth of topics and helps them to gain an appreciation in the embryology of Angiosperms. On the other hand, importance of understanding plant ecology and biodiversity provides an extensive knowledge to the student.

Course Objectives:

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

1. To understand the Anatomy of Angiosperms.
2. To understand the Embryology of Angiosperms.
3. To understand the Basics of Ecology.
4. To understand the Population Community and Production Ecology.
5. To understand the Basics of Biodiversity.

Course Outcomes: At the end of this course, students should be able to:

CO-1	Understand on the organization of tissues and tissue systems in plants
CO2	Illustrate and interpret various aspects of embryology
CO3	Discuss the basic concepts of plant ecology, and evaluate the effects of environmental and Biotic factors on plant communities
CO4	Appraise various qualitative and quantitative parameters to study the population and Community ecology.
CO5	Correlate the importance of biodiversity and consequences due to its loss and enlist the Endemic /endangered flora and fauna from two biodiversity hot spots in India and assess Strategie for their conservation.

Syllabus

Course Details

Unit	Learning Units	Lecture Hours
I	**Anatomy of Angiosperms** Organization of apical meristems: Tunica-carpus theory and Histogen theory. Tissue systems–Epidermal, ground and vascular. Anomalous secondary growth in *Boerhavia* and *Dracaena.* Study of timbers of economic importance -Teak, Redsanders and Rosewood.	12
II	**Embryology of Angiosperms** History of embryology, Structure of anther, types of tapetum. Micro sporogenesis and development of male gametophyte. Structure of ovule, megaspore genesis; monosporic (*Polygonum*), bi sporic (*Allium*) and tetra sporic (*Peperomia*) types of embryo sacs. Outlines of pollination, pollen– pistil interaction and fertilization. Endosperm – Types and biological importance Free nuclear, cellular, helobial and ruminate. Development of Dicot (*Capsella bursa-pastoris*) embryo.	12
III	**Basics of Ecology** Ecology: definition, branches and significance of ecology. Ecosystem: Concept and components, energy flow, food chain, food web, ecological pyramids. Plants and environment: Climatic (light and temperature), edaphic and biotic factors. Ecological succession: Hydrosere and Xerosere.	12
IV	**Population, Community and Production Ecology** Population ecology: Natality, mortality, growth curves, ecotypes, ecads. Community ecology: Frequency, density, cover, life forms, biological spectrum. Concepts of productivity: GPP, NPP and Community Respiration. Secondary production, P/R ratio.	12
V	**Basics of Biodiversity** Biodiversity: Basic concepts, Convention on Biodiversity-Earth Summit. Value of Biodiversity; types and levels of biodiversity and Threats to biodiversity. Biodiversity Hot spots in India. Biodiversity in Eastern Ghats and Western Ghats. Principles of conservation: IUCN threat-categories, RED data book. Role of NBPGR and NBA in the conservation of Biodiversity.	12

Textbook:

- Botany–III(Vrukshasastram-I) : Telugu Akademi, Hyderabad
- Botany–IV(Vrukshasastram-II) : Telugu Akademi, Hyderabad
- Pandey,B.P. (2013)*CollegeBotany, Volume-II*, S. Chand Publishing, NewDelhi
- Pandey,B.P. (2013)*CollegeBotany, Volume-III*,S. Chand Publishing, New Delhi

Recommended Reference book:

- Esau, K. (1971) *Anatomyof Seed Plants*.JohnWileyand 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) *Anatomyof Flowering Plants: An Introduction to Structure and Development.*CambridgeUniversityPress,London.

Course Delivery method: Face-to-face / Blended.

Course has focus on: Foundation **Websites of Interest:**

https://byjus.com/biology/tissues-anatomy-of-angiosperms/

https://onlinecourses.swayam2.ac.in/cec21_bt22/preview

https://explorenaturalcommunities.org/ecology-basics#:~:text=Ecology%20is%20the%20science%20of,and%20with%20their%20physical%20environment.

https://en.wikipedia.org/wiki/Community_(ecology)

https://ec.europa.eu/environment/basics/natural-capital/biodiversity/index_en.htm#:~:text=%22Biodiversity%22%20is%20a%20word%20we,their%20habitats%20and%20their%20genes.&text=Much%20food%20production%20is%20only,that%20pollinate%20plants%20and%20trees.

Co-curricular Activities:

Question and answer session at the end of

class. Observing animations.

Written assignments.

Preparation of models.

Making charts

Group Discussion (GD) /
Quiz.

Power Point
Presentations.

A .G & S .G. SIDDHARTHA DEGREE COLLEGE OF ARTS AND SCIENCE, VUYYURU

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TITLE OF THE PAPER: **Anatomy and Embryology of Angiosperms, Plant Ecology and Biodiversity.**

Model Question Paper Structure for SEE

Max. Time: 3 Hrs. Course Code: BOTT31A Max. Marks: 70M

SECTION -A

Answer all Questions. **(5 X 4 =20)**

(Restrict to a maximum of 2 subdivisions)

1 (a) Explain the Tunica Corpus theory4M L1

OR

(b) Describe the economic importance of Rose wood 4M L1

2 (a) Explain the Nemec Phenomenon 4M L2

OR

(b)Discuss about the Ruminate endosperm 4M L2

3. (a) Explain the Food chain & Food Web. 4M L2

OR

(b) Describe the Ecological pyramids4M L2

4. (a) What are Ecads? Explain. 4M L3

OR

(b) Explain the Biological spectrum4M L3

5. (a) Discuss about the Earth Summit. 4M L3

OR

(b) Identify Biodiveristy hotspots of India 4M L3

SECTION –B

Answer all Questions. **(5 X 10 = 50)**

(Restrict to a maximum of 2 subdivisions)

6. (a)Describe the epidermal tissue system. CO1L1 10M L1

OR

(b)What is anomalous secondary growth? Describe the anomalous secondary growth in *Boerhavia* stem. CO1L1 10M L1

7. (a)What is embryosac? How many types are there? Explain the development of embryo sac studied by you. CO2L2 10M L2

OR

(b) Explain the development of embryo CO2L210M L2

8. (a)What is an ecosystem? Give an account of structure of an ecosystem studied by you.CO3L1 10M L1

OR

(b)What is succession? Give account of xerosere. CO3L1 10M L1

9. (a)What is population ecology? Explain characters of a population studied by you. CO4L2 10M L2

OR

(b) List out the quantitative and qualitative characters of community. Explain qualitative characters of a plant community. CO4L2 10M L2

10. (a)Classify and analyse main values of biodiversity. CO5L4 10M L2

OR

(b) Analyse the major threats to biodiversity. CO5L4 10M L2

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Practical Syllabus

SEMESTER- III **PAPER- III** **CREDITS: 02**

BOTANY	BOTT3IA	WEF: 2023-2024	B. Sc (BZC), AQUA

Title of the paper: Anatomy and Embryology of Angio sperms, Plant Ecology and Biodiversity

NO OF HOURS: 30

Course Prerequisites: Knowledge of Anatomy and Embryology of angiosperms, Plant Ecology and Biodiversity at +2 level.

Course Description: This course will provide one with a basic and comprehensive under standing and skill of identifying anatomical structure and functions. Enable the student with depth of topics and helps them to gain an appreciation in the embryology of Angiosperms. On the other hand, importance of understanding plant ecology and biodiversity provides an extensive knowledge to the student.

Course Objectives:

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

1. To understand the Anatomy of Angiosperms.
2. To understand the Embryology of Angiosperms.
3. To understand the Basics of Ecology.
4. To understand the Population Community and Production Ecology.
5. To understand the Basics of Biodiversity.

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.

Syllabus

Course Details:

Unit	Learning Units	Lecture Hours
I	Tissue organization in root and shoot apices using permanent slides. Anomalous secondary growth in stems of *Boerhavi a*and *Dracaena*.	4
II	Study of anther and ovules using permanent slides/photographs. Study of pollen germination and pollen viability. Dissection and observation of Embryo sac haustoria in *Santalum* or *Argemone.* Structure of endosperm (nuclear and cellular) usingpermanent slides / Photographs. Dissection and observation ofEndosperm haustoria in *Crotalaria*or *Coccinia*. Developmental stages of dicot and monocot embryos using permanent slides /photographs.	12
III	Study of instruments used to measure microclimatic variables; soil thermometer, maximum and minimum thermometer, anemometer, raingauze, and luxmeter. (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). Study of morphological and anatomical adaptations of hydrophytes and xerophytes (02each).	6
IV	Quantitative analysis of herbaceous vegetation in the college campus for frequency, density and abundance. Identification of vegetation/various plants in college campus and comparison with Raunkiaer's frequency distribution law.	6
V	Find out the alpha- diversity of plants in the area.	2

Recommended Reference book:

1. Practical Botany volume II- Bendra and Kumar.
2. Practical Botany volume II-O.P.Sharma.
3. Practical Botany volume III-H.N.Srivastava.
4. Khasim SM., Botanical Microtechnique- Principles & Practice, Capital Publishing Company.

Course Delivery method: Face-to-face / Blended.

Course has focus on: Skill Development.

Websites of Interest:

https://youtu.be/iA5EqQm3hqw
https://youtu.be/_3K2qLw_z_U
https://youtu.be/ZIF4NTDL14U
https://youtu.be/qPUPw7iS86Q
https://youtu.be/qGLo_cUMlHU
https://youtu.be/Spl9GWgXJPQ.

https://youtu.be/ifAdxMspJGY
https://youtu.be/K86XXOdwlB4
https://youtu.be/c83EtBUrWsk
https://youtu.be/enD2OwXBhCM
https://youtu.be/M-TczeGvCCg
https://youtu.be/dDrrTbi88zE
https://youtu.be/aX58F5jWxU8
https://youtu.be/rSsFn1GEuyw

Co-curricular Activities:

Question and answer session at the end of class.
Observing animations.
Written assignments. Preparation
of temporary slides. Group
Discussion (GD)/ Quiz.
Power Point Presentations.

Practical Model Question Paper

Max.: 40 Marks **Min. Pass: 16 Marks**

……..

1. Take T.S of the given material '**A'** (Anatomy), prepare a temporary slide and justify the identification with specific reasons.....**8M**

2. Write the procedure for the experiment '**B'** (Embryology) and demonstrate the same…**8M**

3. Take T.S of the material '**C**'. Prepare a temporary slide and justify the identification with specific reasons 8M

4. Identify the following with specific reasons .....**x**

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**

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Title of the Paper: **Plant tissue culture**

Semester: - V

Course Code	SECBOTT 01	Course Delivery Method	Class Room/Blended Mode - Both
Credits	3	CIA Marks	25
No. of Lecture Hours/ Week	3	Semester End Exam Marks	75
Total Number of Lecture Hours	60	Total Marks	100
Year of Introduction : 2022-23	Year of Offering 2022-2023	Year of Revision –2023-24	Percentage of Revision: 0%

Type of the Course: Skill Enhancement Course (Elective: Theory),

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

CO1: Comprehend the basic knowledge and applications of plant tissue culture.

CO2: Identify various facilities required to set up a plant tissue culture laboratory.

CO3: Acquire a critical knowledge on sterilization techniques related to plant tissue culture.

CO4: Demonstrate skills of callus culture through hands on experience.

CO5: Understand the biotransformation technique for production of secondary metabolites.

Syllabus

Course Details:

Unit	Learning Units	Lecture Hours
I	**Basic concepts of plant tissue culture** (10h) Plant tissue culture: Definition, history, scope and significance. Totipotency, differentiation, dedifferentiation, and re differentiation; types of cultures. Infrastructure and equipment required to establish a tissue culture laboratory.	**12**
II	**Sterilization techniques and culture media (10h)** Aseptic conditions – Fumigation, wet and dry sterilization, UV sterilization, ultra filtration. Nutrient media: Types of media. Composition and preparationof Murashige and Skoog culture medium	**12**
III	**Callus culture technique (10h)** Explant: Definition, different explants for tissue culture, surface sterilization, inoculation methods. Callus culture: Definition, various steps in callus culture. Soma clonal variations and their isolation.	**12**
IV	**Micro propagation (10h)** Direct and indirect morphogenesis, organogenesis, role of PGRs; Somatic embryogenesis and synthetic seeds. Protoplast Culture. Cybrids.	**12**
V	**Applications of plant tissue culture (10h)** Germplasm conservation: cryopreservation methods, slow growth, applications and limitations; cryoprotectants. r DNA Technology. Transgenic plants- gene transfer methods, BT cotton, Golden Rice.	**12**

- References/TextBook/ e-books/websites:

1. Razdan, M.K. (2005) Introduction to Plant Tissue Culture, Oxford & IBH Publishers, Delhi

2. Bhojwani, S.S. (1990) Plant Tissue Culture: Theory and Practical (a revised edition). Elsevier Science Publishers, New York, USA.

ReferenceMaterials ontheWeb/web links:

https://www.youtube.com/watch?v=dFrx-t5J0PA

https://www.youtube.com/watch?v=A6qEgc6Jt3Q

Co-CurricularActivities

(a) Mandatory: (Training of students by teacher in field related skills:(lab:10 + field: 05)

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**.**

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TITLE OF THE PAPER: PLANT TISSUE CULTURE

Model Question Paper

Max. Time: 3 Hrs. Course Code: **SECBOTT01** Max. Marks: 75M

SECTION – A

Answer any FIVE of the following questions. 5 x5=25Marks

(Draw diagrams wherever necessary)

Each answer carries 5marks. At least 1question should be given from each Unit

1. What is totipotency? Explain. **CO1L4.**
2. Describe the method of dry sterilization.**CO2L1.**

3. Enumerate the soma clonal variations.**CO3, L1.**
4. Discuss about the cybrids.**CO4, L2.**

5. Prepare a note on role of auxins.**CO5,L3.**
6. State a note on Bt Cotton.**CO5,L1.**

7. What is morphogenesis? Describe.**CO4,L1.**
8. Describe the synthetic seeds in detail.**CO4,L1.**

SECTIONB 5x10 =50Marks

Answer all questions. Each answer carries 10 marks. Two questions should be given from each unit with internal choice.

9 (a) State the concepts differentiation, dedifferentiation, and Redifferentiation.**CO1,L1**

OR

9 (b) Enumerate an account of Infrastructure and equipment required to establish a tissue culture laboratory.**CO1,L1**
10 (a) Explain various methods of sterilization.**CO2,L4**

OR

10. (b) Discriminate an account of the composition and preparation of MS media.**CO2,L4**

11. (a)Paraphrase various ways of surface sterilization of explants.**CO3,L2**

OR

11. (b) Summarize an account of callus culture.**CO3,L2**

12. (a)Illustrate about somatic embryogenesis.**CO4,L3**

OR

12.(b)Demonstrate the process of Organogenesis in plant tissue culture.**CO4,L3**

13.(a).Explain the steps involved in r DNA Technology.**CO5,L2.**

OR

13(b) Memorize the. Agro bacterium mediated gene transfer method.**CO5,L4**

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Practical Syllabus

SEMESTER- V **PAPER- II** **CREDITS: 03**

BOTANY	SECBOTP01- 501	**WEF: 2023-2024**	**B. Sc (BZC), AQUA**

Title of the paper: PLANT TISSUE CULTURE NO OF HOURS: 30

Type of the Course: Skill Enhancement Course (Elective: Practical),

I. Course Outcomes: Students at the successful completion of the course will be able to:

CO1: Demonstrate the applications of autoclave, laminar airflow, hot air oven.
CO2: Sterilize the glassware and tools used for tissue culturing.
CO3: Prepare different stock solutions, media.
CO4: Measure the growth of callus formed.
CO5: Demonstrate the hardening and acclimatization in green house.

II: Practical (Laboratory) Syllabus :(30Periods): Atleast8Practicals….

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. Explants 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.

III. Lab References:

1. Reinert, J. and M.M. Yeoman, 1982. Plant Cell and Tissue Culture - A Laboratory

2. Manual, Springer-Verlag Berlin Heidelberg

3. 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.

Practical Question Paper

Time : 3hrs **Max.Marks:50**

……

Time Allowed: Three hours **Max.Marks:40**

1. Demonstration of a sterilization technique	'A'	7 M
2. Preparation of MS medium	'B'	8 M
3. Demonstration of callus culture technique/synthetic seeds	'C'	5M
4. Scientific observation and data analysis		4 x 3 = 12 M
D. Tissue culture equipment /photograph		
E. Morphogenesis or organogenesis - photograph		
F. Direct gene transfer methods/Secondary metabolite		
G. Transgenic plant/photograph		
5. Record		5M
6. Viva voce		3M

Evaluation Scheme	Marks
One Major Experiment (Experiment No :)	15
One Minor Experiment (Experiment No :)	10
Slide Preparation, if any	5
Practical Record + Viva Voce	10
Total	40

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Title of the Paper: **mushroom cultivation (7C)**

Semester: - V

Course Code	SECBOTT 02	Course Delivery Method	Class Room/Blended Mode - Both
Credits	3	CIA Marks	25
No. of Lecture Hours/ Week	3	Semester End Exam Marks	75
Total Number of Lecture Hours	60	Total Marks	100
Year of Introduction : 2022-23	Year of Offering 2022-2023	Year of Revision – 2023-24	Percentage of Revision: 0%

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

CO1	Comprehend the value of mushrooms
CO2	Identify the methods of composting and the materials required.
CO3	Acquire a critical knowledge on spawning and casing.
CO4	Demonstrate skills in cultivation of various mushrooms.
CO5	Understand the Post-harvest technology.

Syllabus

Course Details:

Unit	Learning Units	Lecture Hours
I	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. Morphological features of any four edible mushrooms, Button mushroom (*Agaricusbisporus*), Milky mushroom (*Calocybe indica*), Oyster mushroom (*Pleurotussajor-caju*) and Paddy straw mushroom (*Volvariellavolvacea*). Nutritional value of mushrooms; medicinal mushrooms in South India - Ganoderma lucidum, Phellinus rimosus, Pleurotus florida and Pleurotus pulmonaris – their therapeutic value; Poisonous mushrooms - harmful effects.	**12**
II	**Basic requirements of cultivation system** 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. **Compost and composting**: Definition, machinery required for compost making, materials for compost preparation. Methods of composting- long method of composting and short method of composting	**12**
III	**Spawning and casing** Spawn and spawning: Definition, facilities required for spawn preparation; preparation of spawn substrate. Preparation of pure culture, media used in raising pure culture; culture maintenance, storage of spawn. Casing: Definition, Importance of casing mixture, Quality parameters of casing soil, different types of casing mixtures, commonly used materials.	**12**
IV	**Mushroom cultivation** 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	**12**
V	**Post harvest technology** Shelf life of mushrooms; preservation of mushrooms - freezing, dry freezing, drying and canning. Quality assurance and entrepreneurship - economics of different types of mushrooms; value added products of mushrooms. Management of spent substrates and waste disposal of various mushrooms.	**12**

References/TextBook/ e-books/websites

1. TewariPankajKapoor, 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. Web resources suggested by the teacher concerned and the college librarian including reading material.

ReferenceMaterials ontheWeb/web links:

https://www.youtube.com/watch?v=DwMCw14khIU

https://www.youtube.com/watch?v=vggMlUelsoU

IV Co-CurricularActivities

(a) Mandatory:(Training of students by teacher in field related skills:(lab:10 + field: 05)

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.

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TITLE OF THE PAPER: Mushroom Cultivation

Model Question Paper Structure for SEE

Max. Time: 3 Hrs. Course Code: SECBOTT02 Max. Marks: 75M

……

Short Answer Questions **SECTION – A**

Answer any Five questions. **5x5 =25Marks**

Each answer carries 5marks. At least 1questionshould be given from each Unit

1. Extend the medicinal value of Ganoderma.CO2,L2
2. Describe the small village unit.CO2,L1
3. List the facilities required for spawn preparation.CO3,L1
4. Explain weed mold in mushroom cultivation.CO4,L4
5. Illustrate the Novel Value Added Products of Mushrooms.CO5,L3
6. Enumerate the Poisonous mushrooms.CO1,L1
7. Summarize Layout of a mushroom farm.CO2,L2
8. Explain about the Casing oil.CO3,L4

SECTIONB **5x10 =50Marks**

Answer all questions. Each answer carries 10 marks. Two questions should be given from each unit with internal choice.

9. (a) Describe the life cycle of a mushroom.**CO1,L1**

OR

9. (b)Describe the morphological features of Paddy straw and oyster mushroom.**CO1,L1**

10.(a)Explain various types of composting methods.**CO2,L4**

OR

10.(b)Point out basic requirements of mushroom cultivation.**CO2,L4**

11.(a)What is casing? Explain different types of casing mixture and their

Importance.**CO3,L4**

OR

11.(b)Appraise an account of different types of media used for preparation of pure culture.**CO3,L4**

12.(a)Summarize the process of cultivation of Milky mushroom.**CO4,L1**

OR

12. (b) Extend an account cultivation of Oyster mushroom.**CO4,L1**

13. (a) Explain the shelf life of mushrooms? What are the conditions required to improve shelf life of

mushrooms? **CO5,L4**

OR

13. (b)Explain how mushrooms are preserved through Freeze drying method.**CO5,L4**

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Practical Syllabus

SEMESTER- V (7C) **PAPER- V** **CREDITS: 03**

BOTANY	SECBOTT02	**WEF: 2023-2024**	**B. Sc (BZC), AQUA**

MUSHROOM CULTIVATION

Type of the Course: Skill Enhancement Course (Elective: Practical),

I. Course Outcomes: Students at the successful completion of the course will be able to:

CO1: Identify different types of mushroom.
CO2: Demonstrate preparation of pure culture of an edible mushroom.
CO3: Prepare compost and casing mixture.
CO4: Crop and harvest mushrooms.
CO5: Prepare value-added products.

II: Practical (Laboratory) Syllabus :(30Periods): Atleast8Practicals….

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.

III. Lab References:

1. Sushma Sharma Sapna Thakur Ajar NathYadav, 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 UtpalDey, 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.

Question Paper Pattern: Practical

Time: 3 hrs **Max.Marks:50**

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Time Allowed: Three hours **Max.Marks:40**

1. Demonstration of preparing pure culture/mother spawn 'A' 7 M
2. Preparation method for planting spawn and storage/compost and casing material 'B' 8 M

3. Demonstration of spawning and casing/storage and making a value- added product 'C' 5 M

4. Scientific observation and data analysis 4 x 3 = 12M

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 5M
6. Viva Voce 3M

Evaluation Scheme	Marks
One Major Experiment (Experiment No :)	15
One Minor Experiment (Experiment No :)	10
Slide Preparation, if any	5
Practical Record +Viva Voce	10
Total	40

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Value added course

Hydroponics

SYLLABUS

Module-1

1. Introduction to hydroponic technology.
2. Plants commonly used in hydroponics.
3. Plant growth requirements-light, nutrition, temperature.

Module-2

1. Basic concept and design of hydroponic growing system.
2. Medium of growing.
3. Nutrient solutions used.

Module-3

1. Environmental control.
2. Culturing of plants in hydroponic system.

Module-4

1. Irrigation systems.
2. Identification of the pests and diseases affected by plants in hydroponics and their, control.
3. Identification and control of weeds
4. Maintenance of commercial hydroponic farming.

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Value added course

Hydroponics Questions

Section – A

Answer any **six** of the following. **6x5=30M**

1. What are the main points of hydroponics?
2. How does hydroponics work?
3. What is the role of water in hydroponics?
4. What is the aim of hydroponic farming?
5. What are the applications of hydroponics?
6. What is hydroponic solution?
7. Who invented hydroponics?
8. Can hydroponic plants use sunlight?

Section – B

Answer any **TWO** of the following. **2x10=20M**

9. Write the Basic concept and design of hydroponic growing system.
10. Write about commercial hydroponics form?
11. Write about Nutrient solutions used in hydroponics?
12. Culturing of plants in hydroponic system.