



SOMAIYA
VIDYAVIHAR

K J Somaiya College of Science & Commerce
Autonomous (Affiliated to University of Mumbai)



Learning Outcomes based Curriculum

Framework (LOCF)

For

T.Y.B.Sc. Botany

Undergraduate Programme

from

Academic year 2023- 24





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PREAMBLE

The revised syllabus will be effective from the academic year 2022 -23. Autonomy has given us the flexibility to frame the syllabus with a blend of Classical and Applied Botany which will open an array of opportunities in Higher Studies. Skill based courses have been incorporated which will benefit the learners to develop entrepreneurial skills. Successful completion of these courses will provide employability to the learners. It has been prepared according to the unique requirements of Botany students in focus.

The content caters to the current changing needs of the stakeholders, specifically pertaining Food Science, Aroma Therapy, Forestry, Medicinal Botany, Small Scale Industry and Sustainable Agriculture. In this revision, the student will be introduced to the Interdisciplinary approach of learning. The syllabus has been made more relevant by addition of latest topics pertaining to Botany, so as to encourage core competencies and discovery based learning. Learners will be taught topics through experiential learning also. Choice has been given for a skill based core course in both semesters to engage them in the learning process. Elective courses will have more of a practical component over theory. Skill based course will ignite the conscience about global issues amongst the learner to become a sensitive citizen.



Program Specific Outcomes

After Successful completion of T. Y. B. Sc. Botany Curriculum, learners will be able to-

1. Categorize the plant into respective groups.
2. Investigate the mechanism of biological system with respect to genetics and biochemistry.
3. Evaluate the interaction between various biomolecules and internal cellular environment.
4. Perform the propagation of plants by tissue culture technique.
5. Explore the role of essential oil in perfumery.
6. Devise balanced diet plan for given target population
7. Utilize various analytical techniques for validation.
8. Summarize the cellular processes at DNA level.
9. Organize and analyze the data using suitable statistical techniques.
10. Recommend strategies to mitigate environmental degradation.
11. Prioritize the conservation and management of biodiversity.
12. Acquire skill set required to perform practical techniques in Botany.
13. Analyze the effect of climate change and anthropological activities on biodiversity.
14. Create different types of flower arrangements and demonstrate the techniques of botanical art.
15. Apply conservation strategies for sustainability in agriculture.
16. Justify role of forests in community and economic development.



SEMESTER V				
Course	Mod		Cr.	Lect.
Code 23US5BOCC1PD5		Core Course I : <u>Plant Diversity V</u>		02
I	1	Algae		12
	2	Fungi & Plant Pathology		12
	3	Bryophyta		12
Code 23US5BOCC2PD6		Core Course II : <u>Plant Diversity VI</u>		02
II	1	Pteridophytes		12
	2	Gymnosperms		12
	3	Taxonomy		12
Code 23US5BOCC3DCV		Core Course III : <u>Data Collection and Validation</u>		02
III	1	Biostatistics and Bioinformatics		12
	2	Research Methodology		12
	3	Instrumentation		12
Code 23US5BOCC4EVB		Core Course IV : <u>Environmental Botany</u>		02
IV	1	Global Environmental Issues		12
	2	Environmental Health		12
	3	Environmental Management Systems and Audit		12
Select any One Discipline Specific Elective Course from the following				
Code 23US5BODS1DTT		Discipline Specific Elective Course: V <u>Dietetics</u>		02
DSE1	1	Nutrition		12
	2	Meal Planning		12
	3	Food Regulation		12
Code 23US5BODS1ECB		Discipline Specific Elective Course: V <u>Economic Botany</u>		02
DSE1	1	Agronomy		12
	2	Industrial Crops		12



	3	Industrial Processing of Oil		12
Select any One Discipline Specific Elective Course from the following				
Code 23US5BODS2MDB		Discipline Specific Elective Course: VI <u>Medicinal Botany</u>	02	
DSE2	1	Monographs of Drugs		12
	2	Nutrition and Superfoods		12
	3	Plants as Traditional Medicines		12
Code 23US5BODS2PLP		Discipline Specific Elective Course: VI <u>Plant Propagation</u>	02	
DSE2	1	Propagation Practices		12
	2	Propagation Environment		12
	3	Pests and Diseases		12
Select Any One Skill Enhancement Course from the following				
Code 23US5BOSEC1LAC		Skill Enhancement Course: VII <u>Landscape Architecture</u>	02	
SEC1	1	Landscape Designing		12
	2	Computational Modelling for Landscaping		12
	3	Landscape Style		12
Code 23US5BOSEC1PHT		Skill Enhancement Course: VII <u>Post-Harvest Technology</u>	02	
SEC1	1	Post-Harvest Technology		12
	2	Methods of Preservation		12
	3	Processing		12

Course Code	Practical Heading	Credits	Hours / Week
23US5BOCCP1	Practical I	2	
23US5BOCCP2	Practical II	2	
23US5BODSP3	Practical III	2	



SEMESTER VI				
Course	Mod		Cr.	Lect.
Code 23US6BOCC1APB2		Core Course I : <u>Applied Botany II</u>		02
I	1	Environmental Microbiology		12
	2	Applied Microbiology		12
	3	Biotechnology		12
Code 23US6BOCC2FUB2		Core Course II : <u>Functional Botany II</u>		02
II	1	Anatomy		12
	2	Plant Physiology		12
	3	Seed Technology		12
Code 23US6BOCC3FAF2		Core Course III : <u>Forms and Function II</u>		02
III	1	Embryology		12
	2	Palynology		12
	3	Cytogenetics and Molecular Biology		12
Code 23US6BOCC4FAB		Core Course IV : <u>Forestry and Biodiversity</u>		02
IV	1	Forest Mensuration		12
	2	Forest Protection		12
	3	Biodiversity		12
Select any One Discipline Specific Elective Course from the following				
Code 23US6BODS1PBT		Discipline Specific Elective Course: V <u>Plant Biotechnology</u>		02
DSE1	1	Plant Tissue Culture		12
	2	Micro-Propagation		12
	3	Nanotechnology and IPR		12
Code 23US6BODS1FLC		Discipline Specific Elective Course: V <u>Floriculture</u>		02
DSE1	1	Commercial Floriculture		12
	2	Breeding of Floral Crops		12



	3	Cut Flowers and Dry Flowers		12
Select any One Discipline Specific Elective Course from the following				
Code 23US6BODS2ALM		Discipline Specific Elective Course: VI <u>Alternative Medicine</u>		02
DSE2	1	Phytochemistry and Pharmacognosy		12
	2	Conventional Medicine		12
	3	Ethnobotany		12
Code 23US6BODS2GHT		Discipline Specific Elective Course: VI <u>Green House Technology</u>		02
DSE2	1	Green House Construction and Economics		12
	2	Green House Management		12
	3	Crop Protection and Marketing		12
Select Any One Skill Enhancement Course from the following				
Code 23US6BOSEC1SSC		Skill Enhancement Course: VII <u>Soil Sciences</u>		02
SEC1	1	Soil Testing and Fertilizer Recommendation		12
	2	Irrigation Water analysis and Recommendation		12
	3	Management of Problem Soil		12
Code 23US6BOSEC1SMF		Skill Enhancement Course: VII <u>Smart farming</u>		02
SEC1	1	Micro irrigation System		12
	2	Hydroponics		12
	3	Computation		12

Course Code	Practical Heading	Credits	Hours / Week
23US6BOCCP1	Practical I	2	
23US6BOCCP2	Practical II	2	
23US6BODSP3	Practical III	2	



T.Y. B. Sc. (BOTANY) SEMESTER V

Core course - I

COURSE TITLE: Plant Diversity V

COURSE CODE: 23US5BOCC1PD5

[CREDITS - 02]

Course Learning Outcomes

After the successful completion of the Course, the learner will be able to:

1. Correlate between different genera of algae.
2. Illustrate the patterns of life cycle in algae.
3. Compare and Contrast between different fungi based on life cycle, enzymes and utilization.
4. Summarise causative agent, symptom of fungal disease and suggest respective control measures.
5. Identify and classify the bryophytes belonging to division Musci.
6. Illustrate the stages of development in life cycle of Bryophyta.
7. Compile the contributions of Indian Bryologists.

Module 1	Algae	[12L]
Learning Objectives:		
This module is intended to		
<ol style="list-style-type: none"> 1. Compare the stages of lifecycle in different algae. 		
Learning Outcomes:		
After the successful completion of the module, the learner will be able to		
<ol style="list-style-type: none"> 1. Compare and contrast between different genera of algae. 2. Identify the patterns of life cycle in algae. 		
1.1	Life cycle, Systematic position, Occurrence, Thallus, structure and Reproduction of the following – Charophyceae- <i>Chara</i> , Pheophyceae- <i>Ectocarpus</i> .	8 L
1.2	Patterns of life cycle – Haplontic, Diplontic, Diplohaplontic and Haplobiontic.	4 L
References:		
<ul style="list-style-type: none"> • Bilgarmi, K.S and Saha, L.C. (1996) A text book of Algae. CBS Publishers, New Delhi • Bold, H.C. and Wynne, M.J. (1995) Introduction to Algae. Prentice Hall of India, New Delhi 		

- Kashyap, A.K. and Kumar, H.D. Recent advances in Phycology. Rastogy & company.
- Kumar, H.D. (1985) Algal cell biology. East West Press, New Delhi.
- Kumar, H. D. (1999) Introductory Phycology. East West Pvt. Ltd., New Delhi.
- Pandey, B.P. (2004) Algae. S.Chand & Company Ltd., New Delhi.
- Sharma, O.P. (2002) Text book of Algae. Tata McGraw Hill Publ. Comp. Ltd., New Delhi.

Module 2	Fungi and Plant Pathology	[12L]
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Learning Objectives:

This module is intended to

1. Give a comparative account of two classes of fungi.
2. Outline the stages of development of fungi.
3. Identify the disease symptoms in plants.

Learning Outcomes:

After the successful completion of the module, the learner will be able to

1. Distinguish between different fungi based on life cycle, enzymes and utilization.
2. Identify fungal disease and suggest respective control measures.

2.1	Fungal enzymes and Utilization of Nutrients.	2
2.2	Structure, Life cycle and Systematic position of Phycomycetes - <i>Pythium</i> , Ascomycetes - <i>Penicillium</i>	8
2.3	Study of plant disease; Causative agent, Symptoms, Predisposing factors, Disease cycle and Control measures of disease- Tikka disease of Ground nut	2

References:

- Sharma, P.D. (2003) A Text book of Botany-Lower plants. Rastogi Publications, Meerut.
- Smith, G.M. (1976) Cryptogamic Botany Vol.1.Tata Mc Graw Hill Publ. Comp. Ltd., New Delhi.
- Sharma, P.D. (2011) Plant Pathology, Rastogi Publication, Meerut, India.
- Alexopoulos, C.J., Mims, C.W., Blackwell, M. (1996) Introductory Mycology, John Wiley & Sons (Asia) Singapore. 4th edition.
- Mehrotra, R.S. (1991) Plant Pathology, Tata Mc Graw Hill Co. Delhi
- Chatterjee, P.B. (1997) Plant Protection Techniques, Bharati Bhawan, Publ. Patana
- Agrios G.N. (2006) Plant Pathology, Elsevier Academic Press.

- Pandey, B.P. (2009) Plant Pathology, S. Chand Co.
- Agrias G. (2005) Plant Pathology, 5th Ed. Elsevier Academic Press
- Sharma, P.D. (2003) A Text book of Botany-Lower plants. Rastogi Publications, Meerut.
- Ainsworth G.C, Sparrow, K.E., Sussman. The Fungi. Academic Press, New York
- Sharma O.P. (1989) Textbook of Fungi. Tata McGraw Hill, New Delhi.
- Dube H.C. (1996) An Introduction to Fungi. Vikas Publishing House Private Ltd., New Delhi.

Module 3	Bryophyta	[12L]
<p>Learning Objectives:</p> <p>The module is intended to</p> <ol style="list-style-type: none"> 1. Compare internal and external morphology of class representative of Bryophyta. 2. Appreciate the contribution of different bryologists. 		
<p>Learning Outcomes:</p> <p>After the successful completion of the module, the learner will be able to</p> <ol style="list-style-type: none"> 1. Identify and classify the bryophytes belonging to division Musci. 2. Draw and label the stages of development in life cycle of Bryophyta. 3. Summarize the contributions of Indian Bryologists. 		
3.1	Systematic position (Classification by G. M. Smith), Occurrence, Thallus structure, Reproduction – Hepataceae- <i>Marchantia</i> , Musci- <i>Sphagnum</i> .	8
3.2	Distribution of bryophytes in India.	2
3.3	Contribution of Prof. Shivram Kashyap in Indian Bryology.	2
<p>References:</p> <ul style="list-style-type: none"> • Vashishta B.R. (1999) Botany for Degree Students. S. Chand and Company Ltd, New Delhi. • Gangulee H.C. and Kar A. K. (1994) College Botany Vol. II. New Central Book Agency Ltd. Calcutta. • Sharma, P.D. (2003) A Text book of Botany-Lower plants. Rastogi Publications, Meerut. • Smith, G.M. (1976) Cryptogamic Botany Vol.1. Tata Mc Graw Hill Publ. Comp. Ltd., New Delhi. 		



Question Paper Template

T.Y. B. Sc. (BOTANY) SEMESTER V

Core Course- I

COURSE TITLE: Plant Diversity - V

COURSE CODE: 23US5BOCC1PD5 [CREDITS - 02]

Module	Remembering/ Knowledge	Understanding	Applying	Analysing	Evaluating	Creating	Total marks
I	5	5	5	10	5	0	30
II	5	5	5	10	5	0	30
III	5	5	5	10	5	0	30
Total marks per objective	15	15	15	30	15	0	90
% Weightage	16.66	16.66	16.66	33.33	16.66	0	100



T.Y. B. Sc. (BOTANY) SEMESTER V

Core course - II

COURSE TITLE: Plant Diversity VI

COURSE CODE: 23US5BOCC2PD6

[CREDITS - 02]

Course Learning Outcomes

After the successful completion of the Course, the learner will be able to:

1. Compare and Contrast between two pteridophytes.
2. Compare fossil genera with current Pteridophytes.
3. Interpret the evolutionary pattern by comparing fossil and existing organisms.
4. Compare and contrast between *Gnetum* and *Ephedra* based on life cycle.
5. Compare fossil genera with existing Gymnosperms.
6. Compile the distribution of Gymnosperms in India.
7. Classify plants as per Bentham and Hooker system and identify their economic importance.
8. Use the tools for angiosperm taxonomy.

Module 1	Pteridophytes	[12L]
Learning Objectives:		
This module is intended to		
<ol style="list-style-type: none"> 1. Comprehend general features of <i>Lycopodium</i> and <i>Marsilea</i>, and fossil Pteridophytes. 2. Illustrate the contribution of Dr Bribal Sahani. 		
Learning Outcome:		
After the successful completion of the module, the learner will be able to		
<ol style="list-style-type: none"> 1. Distinguish between two pteridophytes. 2. Compare fossil genera with current Pteridophytes. 3. Predict evolutionary pattern by comparing fossil and existing organisms. 		
1.1	Systematic position, Structure and Life cycle of <i>Lycopodium</i> , and <i>Marsilea</i> .	9
1.2	Study of fossil - <i>Lepidodendron</i>	2
1.3	Contribution of Dr. Birbal Sahani to Paleobotany	1
References:		
<ul style="list-style-type: none"> ● Parihar, N. S. 1980. An introduction to Embryophyta, Vol.II.Pteridophyta Central Book Depot, Allahabad. 		

- Rashid,A. 1999. Pteridophyta. Vikas Publishing House, New Delhi
- Sambamurthy AVSS, A Textbook of Bryophyta, Pteridophyta, Gymnosperms and Paleobotany
- Sharma,O.P 2006.Text book of Pteridophyta. . Macmillan India Ltd.,New Delhi.
- Smith,G.M. 1976. Cryptogamic Botany Vol.II. Tata McGraw Hill, Publishing Co. Ltd. New Delhi.

Module 2	Gymnosperms	[12L]
Learning Objectives:		
This module is intended to		
<ol style="list-style-type: none"> 1. Identify distinguishing features of class Gnetopsida. 2. Review characters of fossils. 		
Learning Outcomes:		
After the successful completion of the module, the learner will be able to		
<ol style="list-style-type: none"> 1. Distinguish <i>Gnetum</i> and <i>Ephedra</i>. 2. Compare fossil genera with existing Gymnosperms. 3. Acquaint with the distribution of Gymnosperms in India. 		
2.1	Systematic position, Structure, Anatomy, Life cycle, and Economic importance of the following genera (Classification by Pant); <i>Gnetum</i> , <i>Ephedra</i> .	8
2.2	Study of fossil - <i>Lyginopteris</i> , <i>Pentoxylon</i> .	3
2.3	Distribution of Gymnosperms in India	1
References:		
<ul style="list-style-type: none"> ● Chamberlain,C.J. 1955. Gymnosperms-structure and evolution. Dover Publications, Inc.New York. ● Bhatnagar,S.P. and Alok Moitra 1997.Gymnosperms.New Age Publications ,New Delhi. ● Biswas,C.and Johri,B.M.1999.The Gymnosperms. Narosa Publishing House, New Delhi. ● Chamberlain,C.J .2000 Gymnosperms CBS Publishers, New Delhi. ● Coulter and Chamberlain, 1964. Morphology of Gymnosperm Central Book Depot, Allahabad. ● Ramanujan,C G.K.1976. Indian Gymnosperms in time and space. Today and Tomorrow's printers and publishers, New Delhi. ● Sharma,O.P. 1997. Gymnosperms,Pragati Prakasan,Meerut. 		

- Vashishta,P.C. 1999. Gymnosperms, S.Chand &Company, New Delhi.
- Scott,D.H. 1962. Studies in Fossil Botany. Hafner Publishing Co., New York.
- Shukla,A.C.and Misra,S.P.1975.Essentials of Paleobotany. Vikas Publishing House, New Delhi.

Module 3

Taxonomy

[12L]

Learning Objectives:

The module is intended to

1. Comprehend Bentham and Hooker's system of classification.
2. Recognize tools of angiosperm taxonomy.
3. Interpret the genus and species of an unknown plant using Flora of Presidency of Bombay.

Learning Outcomes:

After the successful completion of the module, the learner will be able to

1. Classify plants as per Bentham and Hooker system and identify their economic importance.
2. Use the tools for angiosperm taxonomy

3.1	Bentham and Hooker's system of classification for flowering plants up to family, with respect to the following prescribed families and economic and medicinal importance of members of the families; Magnoliaceae, Cucurbitaceae, Umbelliferae, Asclepiadaceae, Convolvulaceae, Lamiaceae, Amaranthaceae, Palmae (Aracaceae).	9
3.2	Tools of Angiosperm Taxonomy – Library, Journals, Periodicals, Floras, Monographs. Aims and Objectives of plant systematics	3

References:

- Lawrence GHM (1955), An Introduction to plant Taxonomy, Central Book Depot.
- Lawrence GHM (1964), Taxonomy of Vascular Plants, Mac Millon Co., New York.
- Rendle AB (1967), Classification of flowering plants, Cambridge University Press
- Sharma OP (1990) Plant Taxonomy, Oxford Publishers, New Delhi
- Singh G (1999), Plant systematics: Theory and Practice, Oxford IBH.
- Hooker JD (1879), Flora of British India. Reeve & Co., London 14.



- Hutchinson J (1959), Families of flowering plants, Cambridge University Press

Question Paper Template

T.Y. B. Sc. (BOTANY) SEMESTER V

Core Course- II

COURSE TITLE: Plant Diversity VI

COURSE CODE: 23US5BOCC2PD6 [CREDITS - 02]

Module	Remembering/ Knowledge	Understanding	Applying	Analysing	Evaluating	Creating	Total marks
I	5	5	10	10	5	0	30
II	5	5	10	10	5	0	30
III	5	5	10	10	5	0	30
Total marks per objective	15	15	30	30	15	0	90
% Weightage	16.66	16.66	33.33	33.33	16.66	0	100



T.Y. B. Sc. (BOTANY) SEMESTER V

Core course - III

COURSE TITLE: Data Collection and Validation

COURSE CODE: 23US5BOCC3DCV [CREDITS - 02]

Course Learning Outcomes		
<p>After the successful completion of the Course, the learner will be able to:</p> <ol style="list-style-type: none"> 1. Validate the data using suitable statistical methods. 2. Classify biological data into several relevant biological databases. 3. Reframe the research problem. 4. Summarise the experimental findings into an appropriate report. 5. Use specific analytical instruments for experimental procedures. 6. Perform analytical techniques to estimate biomolecules. 		
Module 1	Biostatistics and Bioinformatics	[12L]
<p>Learning Objectives:</p> <p>This module is intended to</p> <ol style="list-style-type: none"> 1. Criticize different methods of statistical analysis. 2. Categorize various databases. 		
<p>Learning Outcomes:</p> <p>After the successful completion of the module, the learner will be able to</p> <ol style="list-style-type: none"> 1. Evaluate the validity of data using suitable statistical methods. 2. Discover relevant biological data. 		
1.1	Biostatistics – Probability, Regression, Student’s t-test (paired and unpaired),	8
1.2	Bioinformatics – Organization of Biological Data and Databases: Nucleic Acid Sequence Database (Genbank, DDBJ, EMBL), Protein Sequence Database (Swiss-Prot, PIR, UniProt), Structure Database (PDB, SCOP, CATH)	4
<p>References:</p> <ul style="list-style-type: none"> • Bailey, N. Statistical methods in Biology. • Panse and Sukhatme – Statistical methods in Biology. • Snedecore, G.W. and Cochran- Statistical Methods • Purohit S.G., Ranade V.D., Dusane A.V. (2002) Introduction to Biometry Narendra Prakashan Pune. • Rastogi V. B. (2017) Fundamentals of Biostatistics. Medtech, New Delhi. 		

- Mahajan B. K. (1991) Methods of Biostatistics. Jaypee brothers, New Delhi.
- Prasad S. (2006) Elements of Biostatistics. Jogi Publications, Meerut.
- Kar D.K. and Halder S. (2006) Plant Breeding and Biometry. New Central Book Agency (P) Ltd., Kolkata.

Module 2	Research Methodology	[12L]
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Learning Objectives:

This module is intended to

1. Explain fundamental concepts of research methodology.

Learning Outcomes:

After the successful completion of the module, the learner will be able to

1. Construct suitable experimental design.
2. Conclude the experimental findings into an appropriate report.

2.1	Research – General meaning, Motivation, Objectives	4
2.2	Types of Research, Methods of data collection	4
2.3	Research Problem – What is a research problem? Necessity of defining research problem	4

References:

- Kothari C. R. and Garg G. Research Methodology- Methods and Techniques. 2019. Ed. 4th. New Age International Publishers, New Delhi.
- Pandian I. D., Kumar A. and Prasad R. Applications and research in Biotechnology. 2008. A. K. Publications.

Module 3	Instrumentation	[12L]
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Learning Objectives:

The module is intended to

1. Summarize the principle and technique of centrifugation.
2. Illustrate the principle and technique of UV visible spectrometry.

Learning Outcomes:

After the successful completion of the module, the learner will be able to

1. Use centrifugation for experimental procedures.
2. Estimate the concentration of unknown in experimental situations.

3.1	Centrifugation – Principle, Factors affecting rate of sedimentation/ separation, Rotors, Safety precautions, Types of Centrifuges: Based on speed, volume. Density Gradient	2
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	Centrifugation	
3.2	Spectrophotometer – Principle, UV, Visible, Single beam and Double beam, Applications of spectrophotometer	3
References: <ul style="list-style-type: none">Mohan Arora. Biophysics. Ed.1 (2004), Himalaya Publishing House, Mumbai.		

Question Paper Template
T.Y. B. Sc. (BOTANY) SEMESTER V
Core Course- III



COURSE TITLE: Data Collection and Validation
COURSE CODE: 23US5BOCC3DCV [CREDITS - 02]

Module	Remembering/ Knowledge	Understanding	Applying	Analysing	Evaluating	Creating	Total marks
I	0	5	10	10	5	0	30
II	0	5	10	10	5	0	30
III	0	5	10	10	5	0	30
Total marks per objective	0	15	30	30	15	0	90
% Weightage	0	16.66	33.33	33.33	16.66	0	100



T.Y. B. Sc. (BOTANY) SEMESTER V

Core course - IV

COURSE TITLE: Environmental Botany

COURSE CODE: 23US5BOCC4EVB5

[CREDITS - 02]

Course Learning Outcome		
<p>After the successful completion of the Course, the learner will be able to:</p> <ol style="list-style-type: none"> 1. Infer cause and effect of climate change. 2. Relate the process of bioleaching for commercial application. 3. Quote and site cases of global environmental issues. 4. Summarise environmental risk factors for a scenario. 5. Develop strategies for environmental protection. 		
Module 1	Global Environmental Issues	[12 L]
<p>Learning Objectives:</p> <p>This module is intended to</p> <ol style="list-style-type: none"> 1. Outline the causes and effects of climate change. 2. Criticize different environmental issues and bioleaching. 		
<p>Learning Outcomes:</p> <p>After the successful completion of the module, the learner will be able to</p> <ol style="list-style-type: none"> 1. Summarize cause and effect of climate change. 2. Correlate the process of bioleaching for commercial application. 3. Criticize cases of global environmental issues. 		
1.1	Climate change- Causes, Effect and Solution	4
1.2	Bioleaching- Concept, Microorganisms involved, Chemical reaction, Factors affecting, Applications	6
1.3	Case Studies- Bhopal gas tragedy	2
<p>References:</p> <ul style="list-style-type: none"> • Kormondy, E.J. (1996) Concepts of ecology. PHI Learning Pvt. Ltd., Delhi, India. 4th edition. • Ambasht, R.S. and Ambasht, N.K. (2008) A text book of Plant Ecology, CBS Publishers & Distributors PVT. LTD. • Majumdar, R and Kashyap, R (2019) Practical Manual of Ecology and Environmental Science, Prestige Publishers, New Delhi. • Odum E.P. (1978) Ecology. Oxford and IBS Publishing Co., New Delhi. • Sharma P.D. (2010) Ecology and Environment. Rastogi Publications, Meerut. 		



- Fulekar M.H. (2014) Environmental Biotechnology. Science Publisher, USA.
- <https://archive.epa.gov/epa/aboutepa/love-canal-tragedy.html>
Broughton (2005), Environmental Health 4-6, 1-6, The Bhopal disaster and its aftermath: a review, <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC1142333/>

Module 2	Environmental Health	[6 + 6 L]
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Learning Objectives:

This module is intended to

1. Categorize different toxic agents and explain resulting risks.

Learning Outcome:

After the successful completion of the module, the learner will be able to

1. Conclude environmental risk factors for a scenario.

2.1	Ecotoxicology: Toxic agents - Pesticides, Fertilizers, Chemical carcinogen, Medical waste, Plastic waste.	4
2.2	Environmental Risk Assessment - Definition, Scope, Objective, Basic steps in risk assessment; hazard identification, Exposure assessment, Dose-response assessment, risk characterization, Case study	8

References:

- Muzumdar and Dasgupta (2011) Kaohsiung Journal of Medical Science, 27, 360-370, Chronic arsenic toxicity: Studies in West Bengal, India, <https://onlinelibrary.wiley.com/doi/epdf/10.1016/j.kjms.2011.05.003>
- Mazumdar et al (2010) Indian Journal of Community Medicine, 35-2, 331-338, Arsenic Contamination of Ground Water and its Health Impact on Population of District of Nadia, West Bengal, India, <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2940197/>
- Bosecker (1997) FEMS Microbiology Reviews 20, 591-604, Bioleaching: Metal solubilization by microorganisms.

Module 3	Environmental Management Systems and Audit	[12L]
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Learning Objectives:

The module is intended to

1. Discuss aspects of environmental management and audit.
2. Outline the environmental protection laws.

Learning Outcomes:

After the successful completion of the module, the learner will be able to



1. Develop strategies for environmental protection.		
3.1	Environmental audit- Scope and objectives, Types, Procedure and Case study.	4
3.2	Environmental management- Current issues and Problems. Water, Soil.	6
3.3	Environment Protection Acts 1986	2
References: <ul style="list-style-type: none">• Environmental Protection and Laws. Jadhav and Bhosale, V.M.Himalaya publ. House		



Question Paper Template

T.Y. B. Sc. (BOTANY) SEMESTER V

Core Course- IV

COURSE TITLE: Environmental Botany

COURSE CODE: 23US5BOCC4EVB5

[CREDITS - 02]

Module	Remembering/ Knowledge	Understanding	Applying	Analysing	Evaluating	Creating	Total marks
I	0	5	5	10	5	5	30
II	0	5	5	10	5	5	30
III	0	5	5	10	5	5	30
Total marks per objective	0	15	15	30	15	15	90
% Weightage	0	16.66	16.66	33.33	16.66	16.66	100



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Select any One Discipline Specific Elective Course from the following

T.Y. B. Sc. (BOTANY) SEMESTER V



DSE - I

COURSE TITLE: Dietetics

COURSE CODE: 23US5BODS1DTT

[CREDITS - 02]

Course Learning Outcome		
<p>After the successful completion of the Course, the learner will be able to:</p> <ol style="list-style-type: none"> 1. Device a suitable nutritional plan. 2. Frame balance diet. 3. Estimate the nutritive value of different food sources. 4. Plan a meal based on individual requirements. 5. Implement food safety regulations. 6. Suggest suitable organization for certification and registration of food products. 		
Module 1	<u>Nutrition</u>	[12 L]
<p>Learning Objectives:</p> <p>This module is intended to</p> <ol style="list-style-type: none"> 1. Outline the fundamental concepts and regulatory aspects of nutrition. 		
<p>Learning Outcomes:</p> <p>After the successful completion of the module, the learner will be able to</p> <ol style="list-style-type: none"> 1. Formulate a suitable nutritional plan. 2. Practice food regulations. 		
1.1	Food groups – Dairy, Bakery, Fresh fruits and Vegetables, Millets and Grains	4
1.2	Dietary Sources, Functions, and Deficiencies of Nutrients – Carbohydrates, Lipids, Proteins, Minerals, and Vitamins	4
1.3	Balanced Diet, Recommended Dietary Allowance, Food Guide Pyramid, Nutrient Wheel.	4
<p>References:</p> <ul style="list-style-type: none"> • Joshi S. (2011), Nutrition and Dietetics with Indian Case Studies, 3rd Ed., Tata McGraw Hill Education Private Ltd. • Swaminathan M., (2012), Handbook of Food and Nutrition, Bappco. • Shrilakshmi B. (2014), Dietetics, 7th Ed., New Age International Publishers. 		
Module 2	Meal Planning	[6 + 6 L]
<p>Learning Objectives:</p>		

This module is intended to		
1. Identify features and importance of meal planning.		
Learning Outcome:		
After the successful completion of the module, the learner will be able to		
1. Determine the nutritive value of different food sources.		
2. Plan a meal based on individual requirements.		
2.1	Nutritive Value of Millets- Little millet and Kodo millet, Grains- Buckwheat and Corn, Fruits- Orange and Vegetables-Pumpkin.	4
2.2	Three, Five, Seven course meal planning,	4
2.3	Case study- Elderly dietary recall and food habits, Dissemination of nutrition,	4
References:		
<ul style="list-style-type: none"> Joshi S. (2011), Nutrition and Dietetics with Indian Case Studies, 3rd Ed., Tata McGraw Hill Education Private Ltd. Swaminathan M., (2012), Handbook of Food and Nutrition, Bappco. Shrilakshmi B. (2014), Dietetics, 7th Ed., New Age International Publishers. 		
Module 3	Food Regulation	[12L]
Learning Objectives:		
The module is intended to		
1. Describe aspects of food safety and relevant authorities.		
2. Recognize the nutritive importance of food		
Learning Outcomes:		
After the successful completion of the module, the learner will be able to		
1. Implement food safety regulations.		
2. Formulate suitable food combinations.		
3.1	Important definitions under FSSAI, Compliances under FSSAI 2011, Food Safety and Standard Regulations (2011)	4
3.2	Responsibilities of Food Business Operator	2
3.3	Voluntary Based Product Certification – Bureau of Indian Standards (BIS), AGMARK – Concept, Advantages and Applications.	4
3.4	Introduction to International Organizations and Agreements	2



– WHO, ISO, FAO.

References:

- <https://www.fssai.gov.in/>
- <https://haccpindia.org/>
- Food Standards and quality control, <http://ecoursesonline.iasri.res.in/mod/page/view.php?id=111846#:~:text=Food%20standards%3AA%20body%20of,for%20distribution%20or%20for%20sale.>
- Food Quality and Food Safety, <https://ncert.nic.in/textbook/pdf/lehe106.pdf>
- Hassan Z. M. et al (2021) Agricultural Food Security 10-1: 16, The nutritional use of millet grain for food and feed: a review. PMCID: PMC8005370, PMID: [33815778](https://pubmed.ncbi.nlm.nih.gov/33815778/)



Question Paper Template

T.Y. B. Sc. (BOTANY) SEMESTER V

DSE- I

COURSE TITLE: Dietetics

COURSE CODE: 23US5BODS1DTT

[CREDITS - 02]

Module	Remembering/ Knowledge	Understanding	Applying	Analysing	Evaluating	Creating	Total marks
I	0	5	5	10	5	5	30
II	0	5	5	10	5	5	30
III	0	5	5	10	5	5	30
Total marks per objective	0	15	15	30	15	15	90
% Weightage	0	16.66	16.66	33.33	16.66	16.66	100

T.Y. B. Sc. (BOTANY) SEMESTER V

DSE- I

COURSE TITLE: Economic Botany

COURSE CODE: 23US5BODS1ECB4

[CREDITS - 02]

Course Learning Outcome		
<p>After the successful completion of the Course, the learner will be able to:</p> <ol style="list-style-type: none"> 1. Suggest suitable cultivation and processing conditions for discussed fruit, Nut, Vegetable and spice. 2. Compile the uses of fruit, nut, vegetable and spice as per theory. 3. Compare the cultivation and processing of plants used in economically important products. 4. Enlist the uses of economically important plants. 5. Classify edible oils. 6. Perform extraction of edible oil from suitable plant source. 		
Module 1	Agronomy	[12 L]
<p>Learning Objectives:</p> <p>This module is intended to</p> <ol style="list-style-type: none"> 1. Summarize history, processing, cultivation and uses of given fruits and vegetables. 		
<p>Learning Outcomes:</p> <p>After the successful completion of the module, the learner will be able to</p> <ol style="list-style-type: none"> 1. Choose suitable cultivation and processing conditions for discussed fruit, Nut, Vegetable and spice. 2. Enlist the uses of fruit, nut, vegetable and spice as per theory. 		
1.1	<p>Introduction, History, Cultivation, Processing and Uses of;</p> <ul style="list-style-type: none"> • Fruits - Banana, • Nuts – Cashew • Vegetables – Cucumber • Spices - Black Pepper 	12
<p>References:</p> <ul style="list-style-type: none"> • Sen S (1992). Economic Botany, New Central Book Agency, Kolkata. • Kochhar S.L., (2012), Economic Botany in Tropics, MacMillan & Co. New Delhi, India. 		
Module 2	Industrial Crops	[6 + 6 L]
<p>Learning Objectives:</p>		

This module is intended to

1. Describe the cultivation practices of plants having economically important products.

Learning Outcome:

After the successful completion of the module, the learner will be able to

1. Compare the cultivation and processing of plants used in economically important products.
2. Summarize the uses of economically important plants.

2.1	Cultivation, Processing, Uses of 1) Latex yielding plant - <i>Hevea brasiliensis</i> (Rubber) 2) Sugar and sugar products: Sugarcane Beverage- Tea, Types of Tea	12
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References:

- Muzumdar and Dasgupta (2011) Kaohsiung Journal of Medical Science, 27, 360-370, Chronic arsenic toxicity: Studies in West Bengal, India, <https://onlinelibrary.wiley.com/doi/epdf/10.1016/j.kjms.2011.05.003>
- Mazumdar et al (2010) Indian Journal of Community Medicine, 35-2, 331-338, Arsenic Contamination of Ground Water and its Health Impact on Population of District of Nadia, West Bengal, India, <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2940197/>
- Bosecker (1997) FEMS Microbiology Reviews 20, 591-604, Bioleaching: Metal solubilization by microorganisms.

Module 3	Industrial Processing of Oil	[12L]
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Learning Objectives:

The module is intended to

1. Outline aspects of commercial oil production from Sesame and Coconut.
2. Distinguish between grades of oil.

Learning Outcomes:

After the successful completion of the module, the learner will be able to

1. Demonstrate extraction of oil.
2. Identify grades of oil.

3.1	Classification of oils.	4
3.2	Oil producing plants - Cultivation, extraction, and processing of edible oil from Sesame, Coconut.	6
3.3	Grades of oil - Refined, Unrefined, Virgin and Extra virgin	2



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References:

- Sen S (1992). Economic Botany, New Central Book Agency, Kolkata.
- Kochhar S.L., (2012), Economic Botany in Tropics, MacMillan & Co. New Delhi, India.



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Select any One Discipline Specific Elective Course from the following

T.Y. B. Sc. (BOTANY) SEMESTER V

DSE- II

COURSE TITLE: Medicinal Botany

COURSE CODE: 23US5BODS2MDB

[CREDITS - 02]

Course Learning Outcome		
<p>After the successful completion of the Course, the learner will be able to:</p> <ol style="list-style-type: none"> 1. Comment on the potential uses of plants as medicine. 2. Summarise the characteristics and chemical constituents of medicinally important plants. 3. Predict the adulterants present in drug. 4. Devise nutritious food articles. 5. Demonstrate cultivation practices for millets. 6. Recommend use of plants for some ailments 7. Correlate the composition and therapeutic values of cereals, millets, pulses and fruits. 		
Module 1	Monographs of Drugs	[12 L]
<p>Learning Objectives:</p> <p>This module is intended to</p> <ol style="list-style-type: none"> 1. Interpret the internal and external morphology of medicinal plants. 2. Record the active constituents from medicinal plants. 		
<p>Learning Outcomes:</p> <p>After the successful completion of the module, the learner will be able to</p> <ol style="list-style-type: none"> 1. Identify the potential use of plants as medicine. 2. Determine the adulterants present in drug. 		
1.1	<p>Monograph of drugs with respect to biological sources, geographical distribution, macroscopic and microscopic characteristics, chemical constituents, therapeutic uses and adulterants of the following plants / plant part:</p> <ul style="list-style-type: none"> • <i>Datura innoxia</i> (leaf) • <i>Asparagus recemosus</i> (root) • <i>Linum usitatissimum</i> (seed) • <i>Curcuma longa</i> (rhizome) • <i>Terminalia arjuna</i> (bark) • <i>Tinospora cordifolia</i> (stem) 	12
<p>References:</p> <ul style="list-style-type: none"> • Modern Methods of Plant Analysis - Paech and Tracey 		

- Harborne, J.B. (1973). Phytochemical Methods. John Wiley & Sons. New York.
- Textbook of Pharmacognosy- Mohammed Ali
- Trease, G.E. and Evans, W.C. (1983). Pharmacognosy. Bailliere, Tindall, London

Module 2

Nutrition and Superfoods

[6 + 6 L]

Learning Objectives:

This module is intended to

1. Describe the cultivation and properties of common millets.
2. Recognize superfoods.

Learning Outcome:

After the successful completion of the module, the learner will be able to

1. Formulate nutritious food articles.

2.1	Botanical description, Cultivation and Use of common millets- Ragi, Fox tail millet, Barnyard Millet	4
2.2	Nutritional value and health benefits of Superfood - FlaxSeed, Halim, Dil, Beetroot, Turmeric	4
2.3	Nutritional value and formulation of Protein bar, Energy bar	4

References:

- Ahmad S. et al (2021) Frontiers in Pharmacology, Indian medicinal plants and formulations and their potential against COVID-19; Preclinical and clinical research. <https://doi.org/10.3389/fphar.2020.57897>
- Muthu C. et al, (2006) Journal of Ethnobiology and Ethnomedicine 2:43, Medicinal plants used by traditional healers in Kancheepuram District of Tamil Nadu, India doi: [10.1186/1746-4269-2-43](https://doi.org/10.1186/1746-4269-2-43), PMID: [17026769](https://pubmed.ncbi.nlm.nih.gov/17026769/), PMCID: [1615867](https://pubmed.ncbi.nlm.nih.gov/1615867/)
- [Scartezzini P. and Speroni E., \(2000\) Journal of Ethnopharmacology 71 \(1-2\): 23-43, Review on some plants of Indian traditional medicine with antioxidant activity, https://pubmed.ncbi.nlm.nih.gov/10904144/](https://pubmed.ncbi.nlm.nih.gov/10904144/)
- Pandey M.M. et al, (2013) Hindawi – Evidence-Based Complementary and Alternative Medicine, Botanicals in Dietary Supplements, Indian traditional Ayurvedic system of medicine and nutritional supplementation.

Module 3

Plants as Traditional Medicines

[12L]

Learning Objectives:

The module is intended to

1. Describe features of certain ailments.

2. Correlate therapeutic value of some plants.

Learning Outcomes:

After the successful completion of the module, the learner will be able to

1. Suggest use of plants for some ailments
2. Correlate the composition and therapeutic values of cereals, millets, pulses and fruits.

3.1	Symptoms, Causes and Plants used as traditional medicine for the treatment of; Anaemia, Diabetes, Hypertension, Cough and Cold	6
3.2	Source, Composition and Therapeutic value of the following plants: Cereals - Barley, Millets - Bajra, Pulses- Gram, Pea. Fruits- Amla, Guava	6

References:

- Ahmad S. et al (2021) *Frontiers in Pharmacology*, Indian medicinal plants and formulations and their potential against COVID-19; Preclinical and clinical research. <https://doi.org/10.3389/fphar.2020.57897>
- Muthu C. et al, (2006) *Journal of Ethnobiology and Ethnomedicine* 2:43, Medicinal plants used by traditional healers in Kancheepuram District of Tamil Nadu, India doi: [10.1186/1746-4269-2-43](https://doi.org/10.1186/1746-4269-2-43), PMID: [17026769](https://pubmed.ncbi.nlm.nih.gov/17026769/), PMCID: [PMC1615867](https://pubmed.ncbi.nlm.nih.gov/PMC1615867/)
- [Scartezzini P. and Speroni E., \(2000\) Journal of Ethnopharmacology 71 \(1-2\): 23-43, Review on some plants of Indian traditional medicine with antioxidant activity, https://pubmed.ncbi.nlm.nih.gov/10904144/](https://pubmed.ncbi.nlm.nih.gov/10904144/)
- Pandey M.M. et al, (2013) *Hindawi – Evidence-Based Complementary and Alternative Medicine*, Botanicals in Dietary Supplements, Indian traditional Ayurvedic system of medicine and nutritional supplementation.



Question Paper Template

T.Y. B. Sc. (BOTANY) SEMESTER V

DSE- II

COURSE TITLE: Medicinal Botany

COURSE CODE: 23US5BODS2MDB

[CREDITS - 02]

Module	Remembering/ Knowledge	Understanding	Applying	Analysing	Evaluating	Creating	Total marks
I	5	5	5	5	5	5	30
II	5	5	5	5	5	5	30
III	5	5	5	5	5	5	30
Total marks per objective	15	15	15	15	15	15	90
% Weightage	16.66	16.66	16.66	16.66	16.66	16.66	100

T.Y. B. Sc. (BOTANY) SEMESTER V



DSE - II

COURSE TITLE: Plant Propagation

COURSE CODE: 23US5BODS2PLP

[CREDITS - 02]

Course Learning Outcome		
<p>After the successful completion of the Course, the learner will be able to:</p> <ol style="list-style-type: none"> 1. Identify vegetative and reproductive structures of plants. 2. Demonstrate the propagation of different plant species from seed, cutting and layering. 3. Propagate the plants using advanced techniques and manage them. 4. Explain optimum environmental factors for nursery plants. 5. Suggest suitable control measures for pests, insects and weeds. 6. Classify plant disease based on pathogen and mode of transmission. 		
Module 1	Propagation Practices	[12 L]
<p>Learning Objectives:</p> <p>This module is intended to</p> <ol style="list-style-type: none"> 1. Grow new plants from different parts of plants. 2. Differentiate between plants propagated by sexual and asexual method of reproduction. 		
<p>Learning Outcomes:</p> <p>After the successful completion of the module, the learner will be able to</p> <ol style="list-style-type: none"> 1. Identify vegetative and reproductive structures of plants. 2. Plan the propagation of different plant species from seed, cutting and layering. 		
1.1	Advantages and disadvantages of seed propagation, factors affecting propagation.	2
1.2	Propagation by specialized techniques - Apomixis, Aerial Bulbils, Sub-aerial- Runner, offset, Sub-terrestrial- Bulbs, Corms, Rhizomes.	6
1.3	Artificial methods- Cutting; root, stem and leaf	2
1.4	Use of PGR's for rooting	2
<p>References:</p> <ul style="list-style-type: none"> • Sadhu N. K. (1999). Plant Propagation. New Age International Pvt. Ltd., New Delhi. • Bhattacharya S. K. (2011) Landscape gardening and design with plants Raj 		

Publication, New Delhi		
<ul style="list-style-type: none"> Mehaboob A. S. (2010). Handbook of landscape gardening and environment. 		
Module 2	Propagation Environment	[6 + 6 L]
Learning Objectives:		
This module is intended to		
<ol style="list-style-type: none"> Give insight of greenhouse technology. Give an account of recent advances in plant propagation practices. 		
Learning Outcome:		
After the successful completion of the module, the learner will be able to		
<ol style="list-style-type: none"> Propagate the plants using advanced techniques and manage them. Suggest optimum environmental factors for nursery plants. 		
2.1	Equipment - propagation frames, net house, bottom heat box, mist propagation unit, plastic tunnels, propagation units, growing rooms.	4
2.2	Media and Nutrition - Soil, Sand, Peat, Sphagnum moss, Vermiculite, Shredded bark, Coir, Compost, Coco peat	5
2.3	Environmental factors - Light, Water, Humidity control, Temperature, Mineral nutrition	3
References:		
<ul style="list-style-type: none"> Sadhu N. K. (1999). Plant Propagation. New Age International Pvt. Ltd., New Delhi. Bhattacharya S. K. (2011) Landscape gardening and design with plants Raj Publication, New Delhi Mehaboob A. S. (2010). Handbook of landscape gardening and environment. 		
Module 3	Pests and Diseases	[12L]
Learning Objectives:		
The module is intended to		
<ol style="list-style-type: none"> Describe different pests and diseases associated with plants. 		
Learning Outcomes:		
After the successful completion of the module, the learner will be able to		
<ol style="list-style-type: none"> Identify and sustainably control pests, insects and weeds. Classify plant disease based on pathogen and mode of transmission. 		
3.1	Outline of Classification of plant diseases based on	4



	Pathogen, Symptoms and Mode of transmission of pathogen through seed, soil, air, insects.	
3.2	Diseases of Kharif and Rabi Crops- Little leaf of Brinjal, Yellow Vein Mosaic of Okra, Citrus canker, Downy mildew of grapes, Rust of Soybean.	4
3.3	Scientific name, Marks of identification, Host range and Control measures for Aphids, Fruits fly, Caterpillar, Rice Weevil, Pulse beetle, White ant, Mealy-Bug, Mites	4
References: <ul style="list-style-type: none">• Sadhu N. K. (1999). Plant Propagation. New Age International Pvt. Ltd., New Delhi.• Bhattacharya S. K. (2011) Landscape gardening and design with plants Raj Publication, New Delhi• Mehaboob A. S. (2010). Handbook of landscape gardening and environment.		

Question Paper Template

T.Y. B. Sc. (BOTANY) SEMESTER V



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Select any One Skill Enhancement Course from the following

T.Y. B. Sc. (BOTANY) SEMESTER V
SEC - I
COURSE TITLE: Landscape Architecture



COURSE CODE: 23US5BOSEC1LAC

[CREDITS - 02]

Course Learning Outcome		
After the successful completion of the Course, the learner will be able to:		
<ol style="list-style-type: none"> 1. Plan, Design and Set up the garden at different locations 2. Recommend material for different garden locations. 3. Plan several layouts of gardens. 4. Recommend the improvements in the existing layout of gardens. 5. Explain the characteristic features of a specific garden type. 6. Describe the types of gardens. 		
Module 1	Landscape Designing	[12 L]
Learning Objectives:		
This module is intended to		
<ol style="list-style-type: none"> 1. Outline the different locations to establish the garden. 		
Learning Outcomes:		
After the successful completion of the module, the learner will be able to		
<ol style="list-style-type: none"> 1. Set up the garden at different locations 2. Suggest material for different garden locations. 		
1.1	History, objectives, principle and categories of landscape design	3
1.2	Materials used for landscape design.	3
1.3	Garden location: Arches and pergolas, Edge and Hedge, Flower bed, Avenues and Path, Lawn.	3
1.4	Entrances and exits, garden walls, fencing, surfaces and levels, paving and garden walk	3
References:		
<ul style="list-style-type: none"> • Sadhu N. K. (1999). Plant Propagation. New Age International Pvt. Ltd., New Delhi. • Bhattacharya S. K. (2011) Landscape gardening and design with plants Raj Publication, New Delhi. • Mehaboob A. S. (2010). Handbook of landscape gardening and environment. 		
Module 2	Computational Modelling for Landscaping	[12 L]
Learning Objectives:		
This module is intended to		

1. Develop the skill of a garden set up with peculiar features.		
Learning Outcome:		
After the successful completion of the module, the learner will be able to		
<ol style="list-style-type: none"> Plan several layouts of gardens. Suggest the improvements in the existing layout of gardens. 		
2.1	Case study- Site survey, choosing a style, visualising the design, formal and informal.	4
2.2	Garden case history- Adding privacy to the garden, practical and natural style, utilising the available space, opening a view and reorienting a garden.	4
2.3	Overview of softwares that can be used for creating landscapes.	4
References:		
<ul style="list-style-type: none"> Sadhu N. K. (1999). Plant Propagation. New Age International Pvt. Ltd., New Delhi. Bhattacharya S. K. (2011) Landscape gardening and design with plants Raj Publication, New Delhi. Mehaboob A. S. (2010). Handbook of landscape gardening and environment. 		
Module 3	Landscape Style	[12L]
Learning Objectives:		
The module is intended to		
<ol style="list-style-type: none"> Orient with different styles of garden. Review the different architecture and layout of gardens. 		
Learning Outcomes:		
After the successful completion of the module, the learner will be able to		
<ol style="list-style-type: none"> Describe the characteristic features of a specific garden type. Compare types of gardens. 		
3.1	Socio-political history, Expression, Architecture characteristics, elements	4
3.2	Types of gardens - Mughal, English, Spanish, Japanese, French, Italian	6
3.3	Environment Protection Acts 1986	2
References:		



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- Sadhu N. K. (1999). Plant Propagation. New Age International Pvt. Ltd., New Delhi.
- Bhattacharya S. K. (2011) Landscape gardening and design with plants Raj Publication, New Delhi.
- Mehaboob A. S. (2010). Handbook of landscape gardening and environment.

Question Paper Template



T.Y. B. Sc. (BOTANY) SEMESTER V

SEC- I

COURSE TITLE: Landscape Architecture

COURSE CODE: 23US5BOSEC1LAC

[CREDITS - 02]

Module	Remembering/ Knowledge	Understanding	Applying	Analysing	Evaluating	Creating	Total marks
I	0	0	10	5	5	10	30
II	0	0	10	5	5	10	30
III	0	0	10	5	5	10	30
Total marks per objective	0	0	30	15	15	30	90
% Weightage	0	0	33.33	16.66	16.66	33.33	100

T.Y. B. Sc. (BOTANY) SEMESTER V

SEC - I



COURSE TITLE: Post-Harvest Technology

COURSE CODE: 23US5BOSEC1PHT

[CREDITS - 02]

Course Learning Outcome		
After the successful completion of the Course, the learner will be able to:		
<ol style="list-style-type: none"> 1. Infer the quality of food (appearance) 2. Predict the loss at each stage between harvest and consumption. 3. Apply different preservation techniques for food. 4. Suggest suitable storage conditions for fresh produce. 5. Infer the processing of fruits and vegetables. 6. Comment on quality of food processing. 		
Module 1	Post-Harvest Technology	[12 L]
Learning Objectives:		
This module is intended to		
<ol style="list-style-type: none"> 3. Review aspects of harvest ability of produce. 		
Learning Outcomes:		
After the successful completion of the module, the learner will be able to		
<ol style="list-style-type: none"> 1. Infer the quality of food (appearance). 2. Predict the loss at each stage between harvest and consumption. 		
1.1	Maturity, maturity index (visual indices, seed development, start of bud damage, calendar date)	2
1.2	Factors responsible for maturity and ripening, chemicals used in ripening.	2
1.3	Factors for delaying ripening (physical or biotic, physiological).	2
1.4	Harvesting Methods - hand and mechanical, Time of harvest, handling of harvested products - precooling, washing, sorting, grading, sizing and curing. Factors responsible for deterioration of harvested fruits.	6
References:		
<ul style="list-style-type: none"> • TNAU Agricultural Portal, https://agritech.tnau.ac.in/postharvest/pht_intro.html • ICAR- Indian Institute of Agricultural Research / Indian Institute of Horticultural Research, https://www.iihr.res.in/division-post-harvest-technology-and-agricultural-engineering • Post Harvest Technology and Management, 		

https://agricoop.nic.in/sites/default/files/PHTM2014.pdf		
Module 2	Methods of Preservation	[6 + 6 L]
Learning Objectives:		
This module is intended to		
1. Review the techniques of preservation.		
Learning Outcome:		
After the successful completion of the module, the learner will be able to		
1. Apply different preservation techniques for food.		
2. Suggest suitable storage conditions for fresh produce.		
2.1	Principle and different methods of preservation.	3
2.2	Storage of fresh produce - types of storage of fruits and vegetables.	3
2.3	Preservation by varying temperature - Study of freezing process of fruits and vegetables, High temperature - Sun drying.	3
2.4	Canning, and Natural Preservation methods (sugar and salt)	3
References:		
<ul style="list-style-type: none"> • TNAU Agricultural Portal, https://agritech.tnau.ac.in/postharvest/pht_intro.html • ICAR- Indian Institute of Agricultural Research / Indian Institute of Horticultural Research, https://www.iihr.res.in/division-post-harvest-technology-and-agricultural-engineering • Post Harvest Technology and Management, https://agricoop.nic.in/sites/default/files/PHTM2014.pdf 		
Module 3	Processing	[12L]
Learning Objectives:		
The module is intended to		
1. Depict the processing of raw produce.		
Learning Outcomes:		
After the successful completion of the module, the learner will be able to		
1. Infer the processing of fruits and vegetables.		
2. Comment on quality of food processing.		
3.1	Processing of Raw material - Fruits and Vegetables	3
3.2	Green and Ripe Mango processing	3



3.3	Quality control in the food processing industry - Process, inspection, sensory evaluation, packaging, labelling, storage. By-products of Citrus industry - Oil, dry citrus peel	3
3.4	Apple waste- application of pectin in medicine and nutrition. Applications of Papaya waste	3

References:

- TNAU Agricultural Portal, https://agritech.tnau.ac.in/postharvest/pht_intro.html
- ICAR- Indian Institute of Agricultural Research / Indian Institute of Horticultural Research, <https://www.iihr.res.in/division-post-harvest-technology-and-agricultural-engineering>
- Post Harvest Technology and Management, <https://agricoop.nic.in/sites/default/files/PHTM2014.pdf>



COURSE TITLE: Post-Harvest Technology

COURSE CODE: 23US5BOSEC1PHT

[CREDITS - 02]

Module	Remembering/ Knowledge	Understanding	Applying	Analysing	Evaluating	Creating	Total marks
I	0	0	10	5	5	10	30
II	0	0	10	5	5	10	30
III	0	0	10	5	5	10	30
Total marks per objective	0	0	30	15	15	30	90
% Weightage	0	0	33.33	16.66	16.66	33.33	100

Semester V Core Course – 23US5BOCCP1- Practical I		
		Cr. 02
1	Study of following types with the help of fresh material, permanent slides and / or photomicrographs of <i>Chara</i> , <i>Ectocarpus</i> ,	2



	<i>Batrachospermum</i> .	
2	Study of following types with the help of fresh material, permanent slides and / or photomicrographs of <i>Pythium</i> , <i>Penicillium</i> , <i>Puccinia</i> .	3
3	Study of fungal diseases - Tikka Disease of Ground nut, Rust of wheat, Leaf spot of Rice.	1
4	Study of following types with the help of fresh material, permanent slides and photomicrographs of <i>Marchantia</i> , <i>Sphagnum</i> .	2
5	Study of following types with the help of fresh material, permanent slides and/ or photomicrographs of <i>Lycopodium</i> , <i>Marsilea</i> .	2
6	Study of following types with the help of fresh material, permanent slides and / or photomicrographs of <i>Gnetum</i> , <i>Ephedra</i> .	2
7	Study of Fossils - <i>Lepidodendron</i> , <i>Lyginopteris</i> , <i>Pentoxylon</i> .	1
8	Bentham and Hooker's System of Classification for flowering plants up to family with respect to the following prescribed families and economic and medicinal importance for members of these families - Magnoliaceae, Cucurbitaceae, Umbelliferae, Asclepiadaceae, Convolvulaceae, Lamiaceae, Amaranthaceae, Palmae (Aracaceae).	5
9	Identification of genus and species of the plants from the families studied at F.Y.B.Sc. and S.Y.B.Sc. using the Flora of the Presidency of Bombay (Cooke's Flora).	1



Semester V Core Course – Practical II		
		Cr. 02
1	Problems based on Regression.	1
2	Problems based on Student's t-test.	1
3	Problems based on probability. (Law of addition and multiplication)	1
4	Perform BLAST analysis; pBLAST, nBLAST	1
5	Identify type of research based on case study.	1
6	Identify research problems from given case.	1
7	Construct an experimental design for a given case.	1
8	Identification of types of rotors.	1
9	Isolation of chlorophyll pigment using centrifugation.	1
10	Qualitative tests for the detection of heavy metals.	1
11	Study of ecotypes from polluted and non-polluted areas.	1
12	Determination of Leaf Area Index of different types of trees.	1
13	Assessment of ambient air pollution based on leaf area.	1
14	Determination of Stomatal Index.	1
15	Preparation of report of environment risk assessment – Case study.	1
16	Environmental impact assessment – Case study.	1

Semester V DSE– I Practical



		Cr. 01
1	Identification of different food groups using specimens / photomicrographs.	1
2	Device balanced diet plan for given target population. i) Infant ii) Athlete iii) Pregnant Women Senior citizen	3
3	Proximate analysis of any fruit / vegetable / millet. i) Determination of dry matter and moisture. ii) Determination of crude fibre. iii) Determination of crude fat. Determination of soluble proteins	4
4	Planning a meal; i) Three Course ii) Five Course iii) Seven Course	1

Semester V DSE–Practical III	
	Cr. 02

1	Demonstration of cultivation practices of – <ul style="list-style-type: none"> • Seed – Cucumber, Brinjal • Stem cutting – Black paper, Grapes, Tea • Rhizome/Sucker – Banana Single eye bud – Sugarcane	1
2	Identification of different varieties of Banana, Grapes, Cashew, Cucumber, Brinjal, Black pepper using specimen / photomicrograph.	1
3	Identification of by-products of sugarcane industry using specimen / photomicrograph.	1
4	Identification of plants as a source of industrial products- Rubber, Sugar, Tea, Oil using specimen / Photomicrograph.	1
5	Determination of physicochemical parameters of edible oil- Colour, Odour, Specific gravity, Moisture content.	1
6	Determination of Saponification value of oil sample.	1
7	Determination of Acid value of edible oil.	1
8	Determination of peroxide value of edible oil	1
9	Monograph of drugs with respect to biological sources, geographical distribution, macroscopic and microscopic characteristics, chemical constituents, therapeutic uses and adulterants of the following plants /plant part: <ul style="list-style-type: none"> • <i>Datura innoxia</i> (Leaf) • <i>Linum usitatissimum</i>(Seed) • <i>Terminalia arjuna</i> (Bark) • <i>Asparagus recemosus</i> (Root) • <i>Curcuma longa</i> (Rhizome) <i>Tinospora cordifolia</i> (Stem)	6
10	Formulation of protein bar/ Energy bar using super food.	1
11	Estimation of calcium from Ragi, Fox tail millet, Barnyard millet.	1
12	Designing meals using super food.	1
13	Identification of plant sources for the treatment of following diseases: <ul style="list-style-type: none"> • Anaemia, • Diabetes, • Hypertension, Cough and Cold.	1
14	Therapeutic value of following plants: <ul style="list-style-type: none"> • Cereals-Millet (Barley) 	1



	<ul style="list-style-type: none">• Pulses- Gram, Pea Fruits- Amla, Guava	
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Semester V DSE– II Practical		
		Cr. 01
1	Demonstration of propagation by specialised technique – Runner,	1



	Corn, Offset, Bulbil, Rhizome.	
2	Demonstration of propagation by Artificial technique – Cutting, Root and Stem cutting.	1
3	Determination of the effect of plant growth regulator on shoot and root induction using pot culture.	1
4	Identification of equipment for propagation using photomicrograph.	1
5	Determination of significance of different media used for soil preparation using specimens.	1
6	Identification of pests and diseases as mentioned in theory using specimen/ Photomicrograph.	1



SOMAIYA
VIDYAVIHAR

K J Somaiya College of Science & Commerce
Autonomous (Affiliated to University of Mumbai)



Semester VI





T.Y. B. Sc. (BOTANY) SEMESTER VI

Core course - I

COURSE TITLE: Applied Botany II

COURSE CODE: 23US6BOCC1APB2

[CREDITS - 02]

Course Learning Outcomes

After the successful completion of the Course, the learner will be able to:

1. Suggest the effective and efficient method to treat the wastewater.
2. Analyse the air microflora and mycoflora.
3. Formulate the production process of valuable compounds.
4. Reframe and modify the upstream and downstream processing for finished products.
5. Apply the techniques of recombinant DNA technology.
6. Select the technique of plant tissue culture for crop improvement.

Module 1	Environmental Microbiology	[12L]
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Learning Objectives:

This module is intended to

1. Select and apply effective treatment methods to sewage.
2. Enlist microbial component of atmosphere.

Learning Outcomes:

After the successful completion of the module, the learner will be able to

1. Implement the effective and efficient method to treat the wastewater.
2. Analyse the air microflora and mycoflora.

1.1	Waste water – Sources of wastewater, Chemical and Microbiological characteristics and treatment (Primary, Secondary and Tertiary treatment).	6
1.2	Microbiology of Air – Microbial component of atmosphere, aero-microbiological techniques for micro-flora assessment.	6

References:

- Pepper and Gerba (2014), Environmental Microbiology 87-110, <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7149531/>
- Pepper and Gerba (2014), Environmental Microbiology 87-110, <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7149531/>
- Cabral (2010), International Journal of Environmental Research and Public Health,

7-10, 3657-3703, https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2996186/		
<ul style="list-style-type: none"> Gordon and Christie (2014) Microbiology Spectrum 2-6, PLAS-0010-2013, The Agrobacterium Ti Plasmids doi:10.1128/microbiolspec.PLAS-0010-2013 		
Module 2	Applied Microbiology	[12L]
Learning Objectives:		
This module is intended to		
<ol style="list-style-type: none"> 1. Explain the design of the fermenter. 2. Design and plan the production strategies for different products. 		
Learning Outcomes:		
After the successful completion of the module, the learner will be able to		
<ol style="list-style-type: none"> 1. Formulate the production process of valuable compounds. 2. Reframe and modify the upstream and downstream processing for finished products. 		
2.1	Industrial Fermentation – Fermenter (Construction and working)	5
2.2	Production of Antibiotics – Penicillin. Production of Organic acid – Citric acid	7
References:		
<ul style="list-style-type: none"> Pepper and Gerba (2014), Environmental Microbiology 87-110, https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7149531/ 		
Module 3	Biotechnology	[12L]
Learning Objectives:		
The module is intended to		
<ol style="list-style-type: none"> 1. Review techniques of recombinant DNA technology. 2. Summarize the significance of plant tissue culture in crop improvement. 		
Learning Outcomes:		
After the successful completion of the module, the learner will be able to		
<ol style="list-style-type: none"> 1. Apply the techniques of recombinant DNA technology. 2. Select the technique of plant tissue culture for crop improvement 		
3.1	Recombinant DNA Technology for plants - Ti Plasmid.	4
3.2	Various methods of Gene Transfer into plant cells - Protoplast Fusion, Electroporation, Particle Gun method, Microinjection.	4
3.3	Commercial application of PTC in enhancement of	4



	secondary metabolites in flowering plants and nutritional values in agricultural crops.	
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References:

- Glick, B.R., Pasternak, J.J. (2003) Molecular Biotechnology- Principles and Applications of recombinant DNA. ASM Press, Washington.
- Cabral (2010), International Journal of Environmental Research and Public Health, 7-10, 3657-3703, <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2996186/>
- Gordon and Christie (2014) Microbiology Spectrum 2-6, PLAS-0010-2013, The Agrobacterium Ti Plasmids doi:10.1128/microbiolspec.PLAS-0010-2013
- Downey and Rimmer (1993) Advances in Agronomy, Protoplast fusion
- <https://web.archive.org/web/20110728144300/http://pir.uniprot.org/taxonomy/358>, The Wayback Machine
- Furuhashi et al (2019) Scientific Reports 9: 2163, A method using electroporation for the protein delivery of Cre recombinase into cultured *Arabidopsis* cells with an intact cell wall.
- Baltes et al (2017), Gene Editing in Plants, in Progress in Molecular Biology and Translational Science, <https://www.sciencedirect.com/topics/immunology-and-microbiology/biolistic-transformation>
- Jinturkar et al (2011) Gene Delivery Using Physical Methods, Challenges in Delivery of Therapeutic Genomics and Proteomics.



Question Paper Template
T.Y. B. Sc. (BOTANY) SEMESTER VI

Core Course- I

COURSE TITLE: Applied Botany II

COURSE CODE: 23US6BOCC1APB2 [CREDITS - 02]

Module	Remembering/ Knowledge	Understanding	Applying	Analysing	Evaluating	Creating	Total marks
I	5	5	5	10	5	0	30
II	5	5	5	10	5	0	30
III	5	5	5	10	5	0	30
Total marks per objective	15	15	15	30	15	0	90
% Weightage	16.66	16.66	16.66	33.33	16.66	0	100

T.Y. B. Sc. (BOTANY) SEMESTER VI

Core course - II

COURSE TITLE: Functional Botany II

COURSE CODE: 23US6BOCC2FUB2

[CREDITS - 02]

Course Learning Outcomes

After the successful completion of the Course, the learner will be able to:

1. Differentiate cambium from other plant tissues
2. Demonstrate anomalous secondary growth in plants.
3. Criticize the process of transpiration and respiration.
4. Recommend the frequency of watering to the plants.
5. Classify seeds and assess the seed quality.
6. Compare different varieties of seeds.
7. Design strategies for better seed storage.

Module 1

Anatomy

[12L]

Learning Objectives:

This module is intended to

1. Recognise the structural and functional importance of cambium.
2. Locate anomalous secondary growth in plants and infer differences between primary and secondary growth.

Learning Outcome:

After the successful completion of the module, the learner will be able to

1. Differentiate cambium from other plant tissues
2. Demonstrate anomalous secondary growth in plants

1.1	Meristem – Definition and Classification.	2
1.2	Types of Stomata – Paracytic, Anisocytic, Diacytic, Anomocytic, Graminaceous.	2
1.3	Anomalous Secondary Growth – Dicot stem - <i>Bignonia</i> , <i>Aristolochia</i> , <i>Achyranthes</i> . Monocot stem – <i>Dracaena</i> , Dicot root - Storage root (Beet, <i>Raphanus</i>), Root-Stem transition.	8

References:

- Chandurkar,P.J.1966.Plant anatomy.Oxford &IBH Publication Co.,New Delhi.
- Cutler,D.F.,1978 .Applied Plant Anatomy .Orient Longman, New Delhi.
- Cutler,E.G. 1978. Plant Anatomy(Vol.I,II.) Edward Arnold, London.
- Eames ,A.J.,& Mac Daniels,L.H. 1979.An introduction to Plant Anatomy .Mc Graw Hill New York.
- Esau,K.1974. Plant Anatomy. Wiley Eastern Ltd. , New Delhi

- Esau, K. 2002. The anatomy of seed plants.. John Wiley & Sons, New York.
- Fahn, A. 1989. Plant Anatomy, Pergamon press, Oxford, New York.
- Foster, A.S. 1960. Practical Plant Anatomy. Van Nostrand & East West, New Delhi.
- Metcalfe, C.R. and Chalk, L. 1950. Anatomy of the dicotyledons and Monocots (Vol. I, II), Oxford University Press, London.

Module 2	Plant Physiology	[12L]
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Learning Objectives:

This module is intended to

1. Review the process of transpiration, guttation, and respiration.
2. Infer the physiological significance of transpiration and respiration in plants.

Learning Outcomes:

After the successful completion of the module, the learner will be able to

1. Scrutinise the process of transpiration and respiration.
2. Suggest the frequency of watering to the plants.

2.1	Transpiration – Opening and closing of stomata, Factors affecting rate of transpiration, Significance of transpiration,	4
2.2	Guttation – Concept, Structure of Hydathode.	1
2.3	Respiration – Mechanism of aerobic respiration – Glycolysis, TCA cycle, ATP synthesis, Energetics of respiration, Mechanism of Anaerobic respiration.	7

References:

- Noggle and Fritz, 1999. Introductory Plant physiology. Prentice hall, London.
- Salisbury, F.B. and Ross. C. 2000, Plant physiology. John Wiley & Sons, New Delhi.
- Strafford, G.A. 1979 Essentials of Plant Physiology. Heinemann Publishing Co. New York.
- Wilkins, M.B. (Ed) 1984. Advanced Plant Physiology, Pitman Publishing Co. New York.
- William G. Hopkins, 2002. Introduction to Plant Physiology. John Wiley & Sons. Inc. New York.
- Hames, B.D. et al., 1999. Instant notes in Biochemistry. Viva books Pvt. Ltd. New Delhi.
- Jain, J.L. 2000. Fundamentals of Biochemistry. S. Chand & Co. New Delhi.
- Plummer, D.T. 1996. An Introduction to Practical Biochemistry. McGraw Hill
- Satyanarayana U. 1999. Biochemistry. Books and Allied (P) Ltd. Calcutta

Module 3	Seed Technology	[12L]
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Learning Objectives:

The module is intended to

1. Recognize classes of seeds.
2. Emphasize on significance of seedbank.

Learning Outcomes:

After the successful completion of the module, the learner will be able to

1. Classify seeds and assess the seed quality.
2. Distinguish between different varieties of seeds.
3. Design strategies for better seed storage.

3.1	Classes of seed – Breeder, Foundation, Registered, Certified.	
3.2	Seed quality – Physical, Genetic and Physiological seed health	
3.3	Seed storage – Seed bank. Seed drying – Stages of moisture elimination, Methods of drying - natural and artificial. Seed processing: Requirement and techniques	
3.4	Seed Act and rules; Seed policy 2002	

References:

- Modern Methods of Plant Analysis - Paech and Tracey
- Agrawal R. L (2018) Seed technology .Oxford & IBH Publishing Co., New Delhi



Question Paper Template

T.Y. B. Sc. (BOTANY) SEMESTER VI

Core Course- II

COURSE TITLE: Functional Botany II

COURSE CODE: 23US6BOCC2FUB2 [CREDITS - 02]

Module	Remembering/ Knowledge	Understanding	Applying	Analysing	Evaluating	Creating	Total marks
I	5	5	10	10	5	0	30
II	5	5	10	10	5	0	30
III	5	5	10	10	5	0	30
Total marks per objective	15	15	30	30	15	0	90
% Weightage	16.66	16.66	33.33	33.33	16.66	0	100



T.Y. B. Sc. (BOTANY) SEMESTER VI

Core course - III

COURSE TITLE: Forms and Function II

COURSE CODE: 23US6BOCC3FAF2 [CREDITS - 02]

Course Learning Outcomes		
<p>After the successful completion of the Course, the learner will be able to:</p> <ol style="list-style-type: none"> Describe the stages of embryogenesis. Differentiate between the developmental stages of micro and megaspore in plants. Distinguish between different pollen and spore samples. Analyse the honey samples and interpret its quality. Predict the phenotypes in subsequent generations produced in a cross of multiple alleles. Calculate the distance between genes and centromere. Correlate causes of mutations. Classify mutagens to various groups. 		
Module 1	Embryology	[12L]
<p>Learning Objectives:</p> <p>This module is intended to</p> <ol style="list-style-type: none"> Comprehend structural features of anther and ovule, process of fertilization and development of embryo. 		
<p>Learning Outcomes:</p> <p>After the successful completion of the module, the learner will be able to</p> <ol style="list-style-type: none"> Explore the stages of embryogenesis. Compare and contrast between the developmental stages of micro and megaspore in plants. 		
1.1	Microsporangium – Structure of anther, Microsporogenesis, Role of tapetum in microsporogenesis, Development of male gametophyte.	4
1.2	Megasporangium – Types of ovules, Megasporeogenesis, Organisation of female gametophyte (Polygonum type of embryo sac).	4
1.3	Fertilization – Double fertilization and its significance. Development of Embryo – Dicotyledonous type (Capsella type)	4

References:

- Bhojwani, S.S and Bhatnagar, S.P. 2000. The Embryology of Angiosperms, Vikas Publishing House Pvt. Ltd. New Delhi.
- Johri, B.M. 1984. 1984. Embryology of Angiosperms. Springer Verlag. Berlin.
- Maheswari, P. 1980. Recent Advances in the Embryology of Angiosperms.
- Pandey, A.K. 1997. Introduction to Embryology of Angiosperms. CBS Publishers and Distributors, New Delhi.
- Raghavan, V. (2000). Developmental Biology of Flowering plants, Springer, Netherlands.

Module 2

Palynology

[12L]

Learning Objectives:

This module is intended to

1. Recognise features of spore and pollen morphology.
2. Develop analytical methods for pollen grains.
3. Give insight on pollen morphology in plants.

Learning Outcomes:

After the successful completion of the module, the learner will be able to

1. Distinguish between different pollen and spore samples.
2. Evaluate the quality of honey.

2.1	Pollen and Spore morphology– Size and Shape, Polarity, Apertures (NPC), Exine stratification, Exine excrescences	4
2.2	Pollen viability and storage – Tests for pollen viability, Causes of loss of pollen viability, Pollen storage	4
2.3	Melissopalynology – Geographical and floral origin of honey, Physical adulteration, Honey as an environmental monitor	4

References:

- Shivanna, K.R. (2003). Pollen Biology and Biotechnology. Oxford and IBH Publishing Co. Pvt. Ltd. Delhi.
- Nair, P.K. K. (1970). Pollen Morphology of Angiosperms, Latest Ed., Scholar Publications.

Module 3

Cytogenetics and Molecular Biology

[12L]

Learning Objectives:

The module is intended to

1. Summarize the mechanism of crossing over.

2. Explain significance of test cross in chromosome mapping.
3. Classify mutagens.

Learning Outcomes:

After the successful completion of the module, the learner will be able to

1. Predict the phenotypes in subsequent generations produced in a cross of multiple alleles.
2. Calculate the distance between genes and centromere.
3. Correlate causes of mutations.

3.1	Mechanism of crossing over, Multiple alleles	4
3.2	Two point and Three point test cross in chromosome mapping.	4
3.3	Mutation and its types, Mutagen and its classification	4

References:

- Gardner, E.J., Simmons, M.J., Snustad, D.P. (1991) Principles of Genetics, John Wiley & sons, India. 8th edition.
- Russell, P. J. (2010) iGenetics- A Molecular Approach. Benjamin Cummings, U.S.A. 3rd Edition.
- Watson J.D., Baker, T.A., Bell, S.P., Gann, A., Levine, M., Losick, R. (2007) Molecular Biology of the Gene, Pearson Benjamin Cummings, CSHL Press, New York, U.S.A. 6th edition.
- Glick, B.R., Pasternak, J.J. (2003) Molecular Biotechnology- Principles and Applications of recombinant DNA. ASM Press, Washington.
- Campbell A. M., Heyer L. J. (2006) Discovering Genomics, Proteomics and Bioinformatics. _II Edition. Benjamin Cummings.
- Dubey, R.C., 2005 A Text book of Biotechnology S.Chand & Co, New Delhi
- Lewin B. 2000. Genes VII. Oxford University Press, New York.
- Gupta P.K (1995) Genetics and Cytogenetics. Rastogi Publications, Meerut.
- Pawar C.B 2003 (First Edition). Genetics Vol. I and II. Himalaya Publishing House, Mumbai.
- Strickberger 2005. (Third Edition). Genetics. Prentice Hall of India Pvt. Ltd., New Delhi.
- Verma P.S. and Agarwal V.K. (1991), Genetics. S Chand Comp. Ltd. Ramnagar, New Delhi.
- Ahluwalia K.B 2005 (First Edition). Genetics. New Age International Private Ltd. Publishers, New Delhi.



Question Paper Template

T.Y. B. Sc. (BOTANY) SEMESTER V

Core Course- III

COURSE TITLE: Forms and Function II

COURSE CODE: 23US6BOCC3FAF2 [CREDITS - 02]

Module	Remembering/ Knowledge	Understanding	Applying	Analysing	Evaluating	Creating	Total marks
I	5	5	5	10	5	0	30
II	5	5	5	10	5	0	30
III	5	5	5	10	5	0	30
Total marks per objective	15	15	15	30	15	0	90
% Weightage	16.66	16.66	16.66	33.33	16.66	0	100



T.Y. B. Sc. (BOTANY) SEMESTER VI

Core course - IV

COURSE TITLE: Forestry and Biodiversity

COURSE CODE: 23US6BOCC4FAB

[CREDITS - 02]

Course Learning Outcome		
After the successful completion of the Course, the learner will be able to:		
<ol style="list-style-type: none"> 1. Infer specific forest's features. 2. Measure the individual tree parameters. 3. Recommend the strategies for protection of the forests. 4. Suggest conservation methods for mangrove forests of India. 5. Identify and describe the rare and endangered medicinal plants of India. 6. Enlist the rare and endangered medicinal plants of India. 7. Report the legal action for biodiversity conservation. 		
Module 1	Forest Mensuration	[12 L]
Learning Objectives:		
This module is intended to		
<ol style="list-style-type: none"> 1. Acquire information about forest mensuration. 		
Learning Outcomes:		
After the successful completion of the module, the learner will be able to		
<ol style="list-style-type: none"> 1. Characterize a specific forest's features. 2. Measure the individual tree parameters. 		
1.1	Definition, Objectives, Scope.	2
1.2	Measurement of individual tree parameters – Tree diameter and girth, Instruments used.	6
1.3	Measurement of Height – Direct and Indirect methods, Height measuring instruments.	4
References:		
<ul style="list-style-type: none"> • Sagwal S. S. (2016) Introductory Forestry. Kalyani Publisher, New Delhi. • Negi S.S. (2008) Handbook of Forestry. • Chaturvedi and Khanna. (1982) Forest Mensuration. International, Book distributor, New Delhi. 		
Module 2	Forest Protection	[6 + 6 L]
Learning Objectives:		
This module is intended to		

<ol style="list-style-type: none"> 1. Emphasize on the importance of forest protection. 2. Locate different mangrove forests in India. 		
<p>Learning Outcome:</p> <p>After the successful completion of the module, the learner will be able to</p> <ol style="list-style-type: none"> 1. Protect the forests. 2. Appreciate and conserve mangrove forests of India. 		
2.1	Forest protection – Introduction, Importance, Rights, Offences, Defences.	4
2.2	Forest resource monitoring – Forest cover, Biodiversity assessment, Forest vegetation mapping-GPS	4
2.3	Application of remote sensing in forestry – Mangrove forests in India, Role of People Biodiversity Register (PBR)	4
<p>References:</p> <ul style="list-style-type: none"> • Sagwal S. S. (2016) Introductory Forestry. Kalyani Publisher, New Delhi. • Negi S.S. (2008) Handbook of Forestry. • Chaturvedi and Khanna. (1982) Forest Mensuration. International, Book distributor, New Delhi. 		
Module 3	Biodiversity	[12L]
<p>Learning Objectives:</p> <p>The module is intended to</p> <ol style="list-style-type: none"> 1. State the role of various institutes in plant conservation. 		
<p>Learning Outcomes:</p> <p>After the successful completion of the module, the learner will be able to</p> <ol style="list-style-type: none"> 1. Identify the rare and endangered medicinal plants of India. 2. Report the legal action for biodiversity conservation. 		
3.1	Rare and endangered medicinal plants of India.	3
3.2	Biodiversity laws in India and conventions.	5
3.3	Economic value of Biodiversity, trade, restrictions.	2
3.4	Centres for medicinal plants conservation in India- CDRI, TKDL, TBGRI	2
<p>References:</p> <ul style="list-style-type: none"> • Cafaro P. et al (2022) Biological Conservation, 272, 109646 Overpopulation is a major cause of biodiversity loss and smaller human populations are necessary to preserve what is left. 		



<https://www.sciencedirect.com/science/article/abs/pii/S0006320722001999?via%3Dihub>

- Dar S. A. (2022) 195-214 Conservation of Biodiversity in India: Current Status and Future Strategies, https://link.springer.com/chapter/10.1007/978-3-031-06443-2_11
- Chandrakar A. K., Biodiversity Conservation in India, (2011) https://www.researchgate.net/publication/277124537_Biodiversity_Conservation_in_India
- Kannaiyan S., An overview of biological diversity Act 2002, <http://nbaindia.org/uploaded/docs/biological-diversityact-ii.pdf>



Question Paper Template

T.Y. B. Sc. (BOTANY) SEMESTER V

Core Course- IV

COURSE TITLE: Forestry and Biodiversity

COURSE CODE: 23US6BOCC4FAB

[CREDITS - 02]

Module	Remembering/ Knowledge	Understanding	Applying	Analysing	Evaluating	Creating	Total marks
I	5	5	10	5	5	0	30
II	5	5	10	5	5	0	30
III	5	5	10	5	5	0	30
Total marks per objective	15	15	30	15	15	0	90
% Weightage	16.66	16.66	33.33	16.66	16.66	0	100



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Select any One Discipline Specific Elective Course from the following

T.Y. B. Sc. (BOTANY) SEMESTER VI



DSE- I

COURSE TITLE: Plant Biotechnology

COURSE CODE: 23US6BODS1PBT

[CREDITS - 02]

Course Learning Outcome		
After the successful completion of the Course, the learner will be able to:		
<ol style="list-style-type: none"> 1. Design a layout of PTC lab. 2. Prepare nutrient media for plant tissue culture. 3. Use the techniques of PTC. 4. Select and perform a suitable PTC technique. 5. Hardened the tissue culture plants for field transfer. 6. Use the methods in nanotechnology. 7. Apply IPR regulations in different cases. 		
Module 1	Plant Tissue Culture	[12 L]
Learning Objectives:		
This module is intended to		
<ol style="list-style-type: none"> 1. Summarize the requirements for a PTC laboratory. 2. Show the process of callus induction. 		
Learning Outcomes:		
After the successful completion of the module, the learner will be able to		
<ol style="list-style-type: none"> 1. Design a layout of PTC lab. 2. Prepare nutrient media for plant tissue culture. 3. Use the techniques of PTC. 		
1.1	Introduction – History, Current status and Scope of PTC Totipotency.	4
1.2	Organization and Requirements of PTC Laboratory.	3
1.3	Culture media and types Callus induction and its applications.	5
References:		
<ul style="list-style-type: none"> • Razdan M.K. (2002) Introduction to Plant Tissue Culture. Oxford and IBH Publishing Co.Pvt. Ltd., New Delhi. • De K.K. (2004) Plant Tissue Culture. New Central Book Agency (P) Ltd, Calcutta. 		
Module 2	Micro-Propagation	[12 L]
Learning Objectives:		

This module is intended to

1. Elucidate the culturing from different tissues up to hardening.

Learning Outcome:

After the successful completion of the module, the learner will be able to

1. Select and perform a suitable PTC technique.
2. Hardened the tissue culture plants for field transfer.

2.1	Organ Culture; Meristem, Root, Leaf, Anther, Pollen, Ovule, Embryo Organogenesis	6
2.2	Somatic embryogenesis and Synthetic Seeds.	4
2.3	Plant Regeneration and Hardening	2

References:

- Razdan M.K. (2002) Introduction to Plant Tissue Culture. Oxford and IBH Publishing Co.Pvt. Ltd., New Delhi.
- De K.K. (2004) Plant Tissue Culture. New Central Book Agency (P) Ltd, Calcutta.

Module 3

Nanotechnology and IPR

[12L]

Learning Objectives:

The module is intended to

1. Illustrate the concept of nanotechnology and its applications.
2. Outline different aspects of IPR in correlation with plants

Learning Outcomes:

After the successful completion of the module, the learner will be able to

1. Use the methods in nanotechnology.
2. Apply IPR regulations in different cases.

3.1	Nanotechnology – Concept, Processing.	3
3.2	Applications of nanotechnology in Cosmetics and Agriculture.	4
3.3	Introduction of IPR, Concept of copyright, trademark, trade secret, geographical location, and patents.	5

References:

- Jeyaprakash K., (2016) International Journal of Current Microbiology and Applied Sciences, 3: 39 – 43, Intellectual Property Rights – Role in Biotechnology
- Ajeet A. (2012) Nature Proceedings, Role of intellectual property rights in biotechnology and pharmaceutical industries, [https://www.researchgate.net/publication/315014503_Role_of_intellectual_property](https://www.researchgate.net/publication/315014503_Role_of_intellectual_property_rights_in_biotechnology_and_pharmaceutical_industries)



[y rights in biotechnology and pharmaceutical industries](#)

- Singh K. K., Biotechnology and Intellectual Property Rights Legal and Social Implications, Springer, <https://link.springer.com/content/pdf/bfm:978-81-322-2059-6/1.pdf>
- Ganguli P. (2001). Intellectual Property Rights: Unleashing the Knowledge Economy, Tata McGraw-Hill.
- Miller A.R. and Davis M.H. (2000). Intellectual Property: Patents, Trademarks and Copyright in Nutshell, West Group Publishers.
- Acharya N. K. (2001). Textbook on intellectual property rights, Asia Law House.
- Sathya Prabhu, D., Apoorva, S., Nandita, J., Palani Chamy and Devi Rajeswari, V (2018) Purification of protease enzyme from the leaf, seed and pod samples of *Vicia faba L.* International Food Research Journal 25(5): 1904- 1911.
- Mali A. S., Karekar P, Yadav A. V. (2015) Formulation and Evaluation of Multipurpose Herbal Cream. International Journal of Science and Research (IJSR). 4 (11): 1495-1498.
- Ramsden J. J. (2005) Nanotechnology Perceptions 1: 3–17, What is Nanotechnology?
- https://www.nano.gov/sites/default/files/pub_resource/Nanotechnology_Big_Things_Brochure_web_0.pdf
- Ganguli P. (2001). Intellectual Property Rights: Unleashing the Knowledge Economy, Tata McGraw-Hill.
- Miller A.R. and Davis M.H. (2000). Intellectual Property: Patents, Trademarks and Copyright in Nutshell, West Group Publishers.
- Acharya N. K. (2001). Textbook on intellectual property rights, Asia Law House.
- Sharon M., Sharon M., Pandey S., Oza G., (2012), Bio-Nanotechnology - Concepts and Applications, Ane books Pvt. Ltd.



Question Paper Template

T.Y. B. Sc. (BOTANY) SEMESTER VI

DSE- I

COURSE TITLE: Plant Biotechnology

COURSE CODE: 23US6BODS1PBT

[CREDITS - 02]

Module	Remembering/ Knowledge	Understanding	Applying	Analysing	Evaluating	Creating	Total marks
I	0	5	10	5	5	5	30
II	0	5	10	5	5	5	30
III	0	5	10	5	5	5	30
Total marks per objective	0	15	30	15	15	15	90
% Weightage	0	16.66	33.33	16.66	16.66	16.66	100

T.Y. B. Sc. (BOTANY) SEMESTER VI



DSE - I

COURSE TITLE: Floriculture

COURSE CODE: 23US6BODS1FLC

[CREDITS - 02]

Course Learning Outcome		
After the successful completion of the Course, the learner will be able to:		
<ol style="list-style-type: none"> 1. Make use of floriculture techniques. 2. Practice the commercial cultivation of Rose and Chrysanthemum. 3. Utilize breeding techniques for the global market. 4. Develop a business using cut flowers. 5. Perform various dry flower arrangement. 		
Module 1	Commercial Floriculture	[12 L]
Learning Objectives:		
This module is intended to		
<ol style="list-style-type: none"> 1. Discuss basic concepts of floriculture. 2. Demonstrate the cultivation practices for commercially important floral crops. 		
Learning Outcomes:		
After the successful completion of the module, the learner will be able to		
<ol style="list-style-type: none"> 1. Make use of floriculture techniques. 2. Practice the commercial cultivation of Rose and Chrysanthemum. 		
1.1	Floriculture: Definition, Scope, Present status, Future prospects	3
1.2	Cultivation (Climate and soil requirements, Irrigation, Propagation, Manures and fertilizers, Pest and diseases, Pruning and pinching, Species and varieties) of Rose, Chrysanthemum.	6
1.3	Export quality management. Opportunities and Challenges in marketing	3
References:		
<ul style="list-style-type: none"> • Roy A. L. (1992) Introduction to floriculture, 2nd Edition. • Benzakin E, Chai J., Baite M. (2017) Cut flower garden. 		
Module 2	Breeding of Floral Crops	[12 L]
Learning Objectives:		
This module is intended to		

1. Summarize breeding methods for floriculture.		
Learning Outcome:		
After the successful completion of the module, the learner will be able to		
1. Utilize breeding techniques for the global market.		
2.1	Breeding method; Introduction, selection, Domestication. Production of hybrids, Incompatibility problems, Seed production of flower crops. Breeding constraints and Achievements (Chrysanthemum). Flower breeding for the global market.	12
References:		
<ul style="list-style-type: none"> Roy A. L. (1992) Introduction to floriculture, 2nd Edition. Benzakin E, Chai J., Baite M. (2017) Cut flower garden. 		
Module 3	Cut Flowers and Dry Flowers	[12L]
Learning Objectives:		
The module is intended to		
1. Outline the aspects of cut flower industry.		
Learning Outcomes:		
After the successful completion of the module, the learner will be able to		
<ol style="list-style-type: none"> Develop a business using cut flowers. Perform various dry flower arrangement. 		
3.1	Cut Flowers: Scope, Global Scenario, Cut Flower Standards, Grades, Harvest indices.	4
3.2	Production of Dry Flowers: Tools, Materials and Basic Technique, Drying methods, Maintenance of Flower shape, Procedure for embedding Pot-Pourri.	6
3.3	Dry arrangements; Dry flower buckets, Bouquets, Wall hangings, Greeting cards	2
References:		
<ul style="list-style-type: none"> Roy A. L. (1992) Introduction to floriculture, 2nd Edition. Benzakin E, Chai J., Baite M. (2017) Cut flower garden. 		



T.Y. B. Sc. (BOTANY) SEMESTER VI

DSE- I

COURSE TITLE: Floriculture

COURSE CODE: 23US6BODS1FLC

[CREDITS - 02]

Module	Remembering/ Knowledge	Understanding	Applying	Analysing	Evaluating	Creating	Total marks
I	0	5	10	5	5	5	30
II	0	5	10	5	5	5	30
III	0	5	10	5	5	5	30
Total marks per objective	0	15	30	15	15	15	90
% Weightage	0	16.66	33.33	16.66	16.66	16.66	100



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Select any One Discipline Specific Elective Course from the following

T.Y. B. Sc. (BOTANY) SEMESTER VI

DSE - II



COURSE TITLE: Alternative medicine

COURSE CODE: 23US6BODS2ALM

[CREDITS - 02]

Course Learning Outcome		
<p>After the successful completion of the Course, the learner will be able to:</p> <ol style="list-style-type: none"> 1. Perform phytochemical analysis with given sample. 2. Classify the crude drug. 3. Inspect the formulation of herbal drugs. 4. Suggest suitable herbal medicine for a case. 5. Identify household ingredients used as traditional medicine. 6. Protect the traditional knowledge legally. 7. Enlist the plants used by tribals as remedy for certain disorders. 8. Conduct survey for ethnomedicinal plants. 		
Module 1	Phytochemistry and Pharmacognosy	[12 L]
<p>Learning Objectives:</p> <p>This module is intended to</p> <ol style="list-style-type: none"> 1. Correlate the principles of phytochemistry and pharmacognosy. 2. Categorize post-harvest management of medicinal produce. 		
<p>Learning Outcomes:</p> <p>After the successful completion of the module, the learner will be able to</p> <ol style="list-style-type: none"> 1. Perform phytochemical analysis with given sample. 2. Classify the crude drug. 3. Inspect the formulation of herbal drugs. 		
1.1	Phyto-chemistry – Classification of secondary metabolites, Occurrence, Distribution and Phytochemical analysis of Alkaloids, Glycosides, and Tannins	3
1.2	Pharmacognosy – Introduction, Classification of crude drugs - (Morphological, Chemical, and Pharmacological)	3
1.3	Collection and post-harvest management of various categories of medicinal produce, Adulteration and deterioration – Types of adulteration or substitution of herbal drugs, Causes and measures for adulteration, deterioration of herbal drugs	6
<p>References:</p> <ul style="list-style-type: none"> • Modern Methods of Plant Analysis - Paech and Tracey 		

- Harborne, J.B. (1973). Phytochemical Methods. John Wiley & Sons. New York.
- Textbook of Pharmacognosy- Mohammed Ali
- Trease, G.E. and Evans, W.C. (1983). Pharmacognosy. Bailliere, Tindall, London

Module 2	Conventional Medicine	[12 L]
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Learning Objectives:

This module is intended to

1. Compare certain traditional and novel medicines.
2. Acquaint with herbal home remedies.

Learning Outcome:

After the successful completion of the module, the learner will be able to

1. Suggest suitable herbal medicine for a case.
2. Identify household ingredients used as traditional medicine.

2.1	History and use of traditional medicine – Grandma’s pouch Harda, Beheda, Amla, Soonthi, Vekhand, Jyeshtamadhu, Asafoetida, Murudsheng, Tulsi, Ashoka bark, Pimpili, Dikemali, Akkalkara, Turmeric.	6
2.2	Novel medicine – Wheat germ grass, Ginseng. Awareness, control and legislation on use of traditional medicine.	6

References:

- Trivedi P C, (2006) Medicinal Plants: Ethnobotanical Approach, Agrobios, India.
- Purohit and Vyas, (2008) Medicinal Plant Cultivation: A Scientific Approach, 2nd edn. Agrobios, India.

Module 3	Ethnobotany	[12L]
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Learning Objectives:

The module is intended to

1. Identify herbs used by tribals.
2. Discuss legal aspects for conserving traditional knowledge.

Learning Outcomes:

After the successful completion of the module, the learner will be able to

1. Protect the traditional knowledge legally.
2. Enlist the plants used by tribals as remedy for certain disorders.



3. Conduct survey for ethnomedicinal plants.		
3.1	Introduction of Ethnobotany as interdisciplinary science, History and use of medicinal herbs.	4
3.2	Role of ethnomedicobotanical survey in progress of Ayurveda.	2
3.3	Applications of plants used by tribals for certain diseases like. Jaundice, skin diseases, diarrhoea and dysentery. Legal aspects to protect traditional knowledge	6
References: <ul style="list-style-type: none">• Trivedi P C, (2006) Medicinal Plants: Ethnobotanical Approach, Agrobios, India.• Purohit and Vyas, (2008) Medicinal Plant Cultivation: A Scientific Approach, 2nd edn. Agrobios, India.		



COURSE TITLE: Alternative medicine

COURSE CODE: 23US6BODS2ALM

[CREDITS - 02]

Module	Remembering/ Knowledge	Understanding	Applying	Analysing	Evaluating	Creating	Total marks
I	0	5	10	5	5	5	30
II	0	5	10	5	5	5	30
III	0	5	10	5	5	5	30
Total marks per objective	0	15	30	15	15	15	90
% Weightage	0	16.66	33.33	16.66	16.66	16.66	100

T.Y. B. Sc. (BOTANY) SEMESTER VI

DSE - II

COURSE TITLE: Green House Technology

COURSE CODE: 23US6BODS2GHT

[CREDITS - 02]

Course Learning Outcome		
<p>After the successful completion of the Course, the learner will be able to:</p> <ol style="list-style-type: none"> 1. Construct a green house. 2. Estimate the cost for a construction of specific type of greenhouse. 3. Sketch the layout of a green house. 4. Suggest irrigation technique practiced in green house. 5. Demonstrate the cultivation of capsicum or tomato in greenhouse condition. 6. Identify the pest and diseases of greenhouse plants. 		
Module 1	Green House Construction and Economics	[12 L]
<p>Learning Objectives:</p> <p>This module is intended to</p> <ol style="list-style-type: none"> 1. Explain layout and construction of green house. 		
<p>Learning Outcomes:</p> <p>After the successful completion of the module, the learner will be able to</p> <ol style="list-style-type: none"> 1. Build a green house. 2. Estimate the cost for a construction of specific type of greenhouse. 		
1.1	Layout and construction. Types of protected structures – Green house, Polyhouse, Shade-Net House, Low Tunnel House, Glass House	6
1.2	Estimated construction cost for greenhouse, Variable cost, Capital cost, Fixed cost, Labour requirements.	3
1.3	Economical green house and Automated greenhouse.	3
<p>References:</p> <ul style="list-style-type: none"> • Tiwari G.N. (2009) Greenhouse technology for controlled environment. Narosa Publication. 		
Module 2	Green House Management	[12 L]
<p>Learning Objectives:</p> <p>This module is intended to</p> <ol style="list-style-type: none"> 1. Illustrate techniques of greenhouse management. 		
<p>Learning Outcome:</p> <p>After the successful completion of the module, the learner will be able to</p> <ol style="list-style-type: none"> 1. Design a green house. 2. Suggest irrigation technique practiced in green house. 		



2.1	Land Preparation – Site Selection, Land and Seed bed preparation, Sowing, Planting seedlings	4
2.2	Irrigation Techniques – Micro-irrigation, Micro-Sprinkler, Irrigation and Fertigation.	4
2.3	Microclimate Control – Heating, Cooling, Insulation, Humidity control, Ventilation Care and Maintenance	4
References:		
<ul style="list-style-type: none"> Tiwari G.N. (2009) Greenhouse technology for controlled environment. Narosa Publication. 		
Module 3	Crop Protection and Marketing	[12L]
Learning Objectives:		
The module is intended to		
<ol style="list-style-type: none"> Elaborate cultivation of greenhouse crops. Encourage the organic terrace farming. 		
Learning Outcomes:		
After the successful completion of the module, the learner will be able to		
<ol style="list-style-type: none"> Cultivate capsicum or tomato in greenhouse condition. Identify the pest and diseases of greenhouse plants. 		
3.1	Cultivation of Green House Crops – Capsicum and Tomato	4
3.2	Pest and Diseases of Green House Plants	4
3.3	Post-harvest management practices	4
References:		
<ul style="list-style-type: none"> Tiwari G.N. (2009) Greenhouse technology for controlled environment. Narosa Publication. 		

Question Paper Template
T.Y. B. Sc. (BOTANY) SEMESTER VI
DSE- II
COURSE TITLE: Green House Technology
COURSE CODE: 23US6BODS2GHT



[CREDITS - 02]

Module	Remembering/ Knowledge	Understanding	Applying	Analysing	Evaluating	Creating	Total marks
I	0	5	10	5	5	5	30
II	0	5	10	5	5	5	30
III	0	5	10	5	5	5	30
Total marks per objective	0	15	30	15	15	15	90
% Weightage	0	16.66	33.33	16.66	16.66	16.66	100



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Select any One Skill Enhancement Course from the following

T.Y. B. Sc. (BOTANY) SEMESTER VI

SEC - I

COURSE TITLE: Soil Sciences

COURSE CODE: 23US6BOSEC1SSC

[CREDITS - 02]

Course Learning Outcome

After the successful completion of the Course, the learner will be able to:

1. Test the soil to determine its fertility status.
2. Test the irrigation water for supplying it to the crop.
3. Suggest suitable management method for problem soils.

Module 1	Soil Testing and Fertilizer Recommendation	[12 L]
Learning Objectives:		
This module is intended to		
<ol style="list-style-type: none"> 1. Show soil fertility analysis methods. 		
Learning Outcomes:		
After the successful completion of the module, the learner will be able to		
<ol style="list-style-type: none"> 1. Test the soil to determine its fertility status. 		
1.1	Soils of Maharashtra Soil fertility and productivity, Nutrient sources. Fertilizers and Manures.	2
1.2	Essential plant nutrients – Classification and essentiality criteria of nutrients. Forms absorbed by plants.	2
1.3	Functions and deficiency symptoms of primary, secondary and micronutrients and their corrections in plants.	2
1.4	Critical limits of micronutrients in soil and plants. Factors affecting nutrient availability in soil.	1
1.5	Bio-fertilizers, Types and their role in soil fertility and productivity.	2
1.6	Methods of soil testing and their importance. fertilizer recommendation.	1
1.7	Integrated Nutrient Management.	1
1.8	Soil Fertility Evaluation – Classification.	1
References:		
<ul style="list-style-type: none"> • Brady, N.C and Weil, R.R. 2002. The Nature and Properties of Soils, 13th Ed. Person Edu. • Khajanchi, L; Meena, S.K; Gupta, C.K; Saxena, G. Yadav and Singh, G. 2008-9. Diagnosis and Management of Poor Quality Water and Salt Affected Soil. CSSRI, Karnal, Haryana (India) and ICAR, Manual. 		
Module 2	Irrigation Water analysis and Recommendation	[12 L]

Learning Objectives:

This module is intended to

1. Demonstrate water analysis for checking its suitability.

Learning Outcome:

After the successful completion of the module, the learner will be able to

1. Test the irrigation water for supplying it to the crop.

2.1	Important characteristics and sources of irrigation water.	2
2.2	Quality parameters of irrigation water and their critical values for safe use for irrigating the crops.	4
2.3	Effect of irrigation water on soil and plant health.	2
2.4	Characterization and management of brackish water for irrigation.	4

References:

- Das, D.K. 2011. Introductory Soil Science, Kalyani Publishers, Ludhiana, New Delhi, Nodia Hyderabad, Ch.

Module 3

Management of Problem Soil

[12L]

Learning Objectives:

The module is intended to

1. Identify different soil problems.

Learning Outcomes:

After the successful completion of the module, the learner will be able to

1. Suggest suitable management method for problem soils.

3.1	Area and distribution of problem soils – acidic, saline, sodic, saline-sodic and physically degraded soils.	2
3.2	Origin and basic concept of problematic soils.	1
3.3	Factors responsible for formation of problematic soils.	1
3.4	Characterization of problem soils (Salt Affected Soils).	2
3.5	Physical, chemical and biological properties of problem soils.	2
3.6	Management of problem (Salt Affected) soils.	1
3.7	Agronomic practices in relation to problematic soils.	1
3.8	Cropping pattern/sequence for use of irrigation water as per	2



	their quality.	
References: <ul style="list-style-type: none">• Jurinak, J.J. 1978. Salt Affected Soils, Department Soil Science and Biometeorology. Utah State Univ.• USDA Handbook No. 60. 1954. Diagnosis and Improvement of Saline and Alkali Soils Oxford and IBH.		

Question Paper Template
T.Y. B. Sc. (BOTANY) SEMESTER VI
SEC- I
COURSE TITLE: Soil Sciences
COURSE CODE: 23US6BOSEC1SSC
[CREDITS - 02]



Module	Remembering/ Knowledge	Understanding	Applying	Analysing	Evaluating	Creating	Total marks
I	0	0	10	5	5	10	30
II	0	0	10	5	5	10	30
III	0	0	10	5	5	10	30
Total marks per objective	0	0	30	15	15	30	90
% Weightage	0	0	33.33	16.66	16.66	33.33	100

T.Y. B. Sc. (BOTANY) SEMESTER V

SEC - I

COURSE TITLE: Smart Farming

COURSE CODE: 23US6BOSEC1SMF

[CREDITS - 02]

Course Learning Outcome

After the successful completion of the Course, the learner will be able to:

1. Inspect a micro-irrigation system.
2. Select appropriate method of hydroponics.
3. Apply IoT and Machine learning in agriculture.

Module 1	Micro irrigation System	[12 L]
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Learning Objectives:

This module is intended to

1. Outline the features of micro irrigation systems.

Learning Outcomes:

After the successful completion of the module, the learner will be able to

1. Inspect a micro-irrigation system.

1.1	Introduction, Types - Drip and Sprinkler, Fertigation.	4
1.2	Tools and Equipment	4
1.3	Benefit and Challenges	4

References:

- Introduction to micro irrigation systems, <https://ncert.nic.in/vocational/pdf/kvmt101.pdf>
- Meshram V. et al, (2021) 1: 100010, Artificial Intelligence in the Life Sciences, Machine learning in agriculture domain: A state-of-art survey
- Fastellini G and Schillaci C, Precision farming and IoT case studies across the world.
- Suanpang P. and Jamjuntr P. (2019) Journal of Advance Agricultural technologies 6-4: 241-245, A Smart Farm Prototype with an Internet of Things (IoT) Case Study: Thailand.
- Reddy K S P Et al, (2020) IoT based Smart Agriculture using Machine Learning <https://ieeexplore.ieee.org/document/9183373>
- Loke K. et al, IoT for Agricultural India – A case study. A conference publication.
- https://www.researchgate.net/publication/333419492_IoT_for_Agricultural_India_-_A_Case_Study
- Doshi J. et al (2019) Procedia Computer Science 160:746 – 75, Smart Farming using IoT, a solution for optimally monitoring farming conditions
- Sokolova L., (2021) What to know about smart farming using IoT, <https://www.forbes.com/sites/forbestechcouncil/2021/09/22/what-to-know-about-smart-farming-using-iot/?sh=5982adc26afb>

Module 2	Hydroponics	[12 L]
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Learning Objectives:

This module is intended to

1. Illustrate the features of hydroponics.

Learning Outcome:

After the successful completion of the module, the learner will be able to

1. Select appropriate method of hydroponics.

2.1	Basic principle, Advantages, Disadvantages and Types.	4
2.2	Nutrient solution and System monitoring- pH, Salinity, Conductivity	4
2.3	Indoor Vertical farming, Organic Hydroponics	4

References:

- Introduction to micro irrigation systems, <https://ncert.nic.in/vocational/pdf/kvmt101.pdf>
- Meshram V. et al, (2021) 1: 100010, Artificial Intelligence in the Life Sciences, Machine learning in agriculture domain: A state-of-art survey
- Fastellini G and Schillaci C, Precision farming and IoT case studies across the world.
- Suanpang P. and Jamjuntr P. (2019) Journal of Advance Agricultural technologies 6-4: 241-245, A Smart Farm Prototype with an Internet of Things (IoT) Case Study: Thailand.
- Reddy K S P Et al, (2020) IoT based Smart Agriculture using Machine Learning
- <https://ieeexplore.ieee.org/document/9183373>
- Loke K. et al, IoT for Agricultural India – A case study. A conference publication.
- https://www.researchgate.net/publication/333419492_IoT_for_Agricultural_India_-_A_Case_Study
- Doshi J. et al (2019) Procedia Computer Science 160:746 – 75, Smart Farming using IoT, a solution for optimally monitoring farming conditions
- Sokolova L., (2021) What to know about smart farming using IoT, <https://www.forbes.com/sites/forbestechcouncil/2021/09/22/what-to-know-about-smart-farming-using-iot/?sh=5982adc26afb>

Module 3

Computation

[12L]

Learning Objectives:

The module is intended to

1. Identify applications of IoT and Machine learning in agriculture.

Learning Outcomes:

After the successful completion of the module, the learner will be able to

1. Apply IoT and Machine learning in agriculture



3.1	IoT – Definition, Components - Hardware, Water and Nutrients,	4
3.2	Connections – Wired, Wireless. Softwares Machine Learning: Definition.	4
3.3	Application in Agriculture Customization – Concept and Case study	4

References:

- Introduction to micro irrigation systems, <https://ncert.nic.in/vocational/pdf/kvmt101.pdf>
- Meshram V. et al, (2021) 1: 100010, Artificial Intelligence in the Life Sciences, Machine learning in agriculture domain: A state-of-art survey
- Fastellini G and Schillaci C, Precision farming and IoT case studies across the world.
- Suanpang P. and Jamjuntr P. (2019) Journal of Advance Agricultural technologies 6-4: 241-245, A Smart Farm Prototype with an Internet of Things (IoT) Case Study: Thailand.
- Reddy K S P Et al, (2020) IoT based Smart Agriculture using Machine Learning
- <https://ieeexplore.ieee.org/document/9183373>
- Loke K. et al, IoT for Agricultural India – A case study. A conference publication.
- https://www.researchgate.net/publication/333419492_IoT_for_Agricultural_India_-_A_Case_Study
- Doshi J. et al (2019) Procedia Computer Science 160:746 – 75, Smart Farming using IoT, a solution for optimally monitoring farming conditions
- Sokolova L., (2021) What to know about smart farming using IoT, <https://www.forbes.com/sites/forbestechcouncil/2021/09/22/what-to-know-about-smart-farming-using-iot/?sh=5982adc26afb>

Question Paper Template

T.Y. B. Sc. (BOTANY) SEMESTER V

SEC- I

COURSE TITLE: Smart Farming

COURSE CODE: 23US6BOSEC1SMF

[CREDITS - 02]

Module	Remembering/ Knowledge	Understanding	Applying	Analysing	Evaluating	Creating	Total marks
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I	0	0	10	5	5	10	30
II	0	0	10	5	5	10	30
III	0	0	10	5	5	10	30
Total marks per objective	0	0	30	15	15	30	90
% Weightage	0	0	33.33	16.66	16.66	33.33	100

Semester VI Core Course – Practical I

Semester VI Core Course – Practical I		Cr. 02
1	Determination of COD of given sewage sample.	1
2	Study of aeromicrobiota by exposed petri-plate method.	1
3	Study of sewage sample by serial dilution.	
4	Identify types of fermenters using photomicrographs.	1
5	MIC of Sugar	1
6	Demonstration of citric acid production from suitable microbial culture.	1



7	Study of Ti plasmid using photomicrograph.	1
8	Explore role of PTC in improvement of flowering plant quality; Case study.	1
9	Explore role of PTC in importance of quality of agricultural crops; Case study.	1
10	Qualitative analysis of respiration (evolution of CO ₂) germinating seeds by conical flask method.	1
11	Determination of rate of respiration in germinating seeds using Ganong's respirometer.	1
12	Demonstration of fermentation using Kuhne's Tube.	1
13	Qualitative analysis of respiratory enzymes; Oxidase, Peroxidase and Dehydrogenase in plant tissues.	1
14	Study of seed treatment and seed processing instruments using photomicrographs.	1
15	Study of physical characteristics of different crop seeds and their shapes.	1
16	Determination of seed viability.	1

Semester VI Core Course – Practical II		
		Cr. 02
1	Study of various stages of Microsporogenesis, Megasporeogenesis and embryo development with the help of permanent slides and photomicrographs.	1
2	To mount embryo of <i>Citrus</i> , <i>Cucurbita</i> , <i>Scoparia</i> and Maize.	1
3	Determination of pollen viability.	1
4	Observation of <i>in vivo</i> growth of pollen tube in <i>Portulaca</i> .	1
5	To study the germination of pollen grains and growth of pollen tube in varying concentrations of sucrose.	1
6	Study of airborne pollen grains using gravity slide samplers.	1
7	Study of pollen morphology (NPC analysis) of the following by Chitley's method; <i>Hibiscus</i> , <i>Datura</i> , <i>Ocimum</i> , <i>Pancreatium</i> , <i>Canna</i> .	1
8	Pollen analysis of honey sample.	1
9	Problems based on three-point test cross genetic mapping	1
10	Identification of types of mutation.	1
11	Study of various stages of Microsporogenesis, Megasporeogenesis and embryo development with the help of permanent slides and photomicrographs.	1
12	Study of Instruments required for measurement of individual tree using photomicrographs / specimens.	1
13	Measurement of girth, diameter and volume of the plant.	1
14	Tree measurement by shadow method.	1
15	Study of common mangrove plants with the help of specimen or photomicrographs.	1
16	Study of anatomical features of wood with the help of specimen or photomicrographs.	1
17	Study of defects in wood due to natural forces with the help of specimen or photomicrographs; <ul style="list-style-type: none"> • Knots- dead and live knots, Twist, Shakes-star, cup/ring, heart, Rind galls, Upsets • Defects due to insects: Beetles, Termites, Marine Boars • Defects due to fungi: stain, decay 	2



	<ul style="list-style-type: none">• Defects due to defective seasoning: Bow, Cup, Check, Split, Honey, combing.• Defects due to defective conversion: Boxed heart, Machine burnt, Machine notches, Miscut, Imperfect grain	
18	Identification of rare and endangered medicinal plants of Western Ghats using photomicrographs/ Specimens.	1



		Cr. 01
1	Designing and Layout of PTC Laboratory.	1
2	Preparation of MS media.	1
3	Study of various sterilization techniques using photomicrographs.	1
4	Demonstration of callus induction using suitable explant.	1
5	Identification of Types of Calluses using photomicrographs.	1
6	Demonstration of hardening of tissue culture plants.	1
7	Synthesis of silver nano-particles.	1
8	Submission of Patent form.	1
9	Preparation of questionnaire (Activity / Submission)	1
10	Application of nano-technology in Cosmetics / Agriculture (Case Study)	1
	OR	
Semester VI DSE– I Practical III		
Code: 23US6BODSEC1PFL		Cr. 01
1	Demonstration of cultivation of Orchid, Carnation, Anthurium, Gerbera.	3
2	Training and pruning of commercial flowers.	1
3	Demonstration of time of harvest of some plants – Jasmine, sp., Chrysanthemum, Rose.	1
4	Propagation of Rose.	1
5	Demonstration of embedding Pot-Pourri.	1
6	Demonstration of Dry flower arrangement.	1
7	Visit to local florist and prepare a Report.	1
8	Survey of floral market, Report.	1

Semester VI DSE– II Practical III		
		Cr. 01
1	Perform suitable phytochemical tests to detect the presence of various secondary metabolites using suitable plant extract.	1
2	Detection of adulterants in following drugs- Gulvel starch, Arjuna bark, Honey, Ashoka bark.	1
3	Identification of plants of Grandma's pouch using photomicrographs/ Specimens.	1
4	Identification of novel medicines using photomicrographs/ Specimens.	1
5	Preparation of Wheat grass juice.	1
6	Identification of plants used by tribals for diseases-Jaundice, skin diseases, diarrhoea and dysentery	1
7	Visit to Tribal region- Alibaug, Jawhar. (Survey if interaction takes place with tribals)	1
OR		
Semester VI DSE– II Practical III		
		Cr. 01
1	Study of various types of green houses with the help of photomicrographs.	1
2	Study of core material and covering materials with the help of photomicrograph.	1
3	Application of computers in green house.	1
4	Study of green house plants - Soil requirement, temperature, irrigation, fertilizer requirements and propagation methods for Capsicum, Tomato, Zucchini.	3
5	Preparation of seed beds.	1
6	Identification of major pests and diseases with the help of photomicrograph.	1



Scheme of Examination:

Theory Course:

- **Internal Assessment:** Mid Sem Examination 25 Marks + Assignment 15 Marks

Or

Value Added Course for “Aromatherapy” for total 40 Marks

- **External Assessment:** Semester End Examination question paper based on Bloom’s Taxonomy 60 Marks

Practical Assessment: Continuous assessment with ICT tools (20 Marks), Semester End Exam (30 Marks) / Course

Modes for Continuous Assessment based on feasibility

- Mini-projects + Presentation
- Models
- Tests
- Worksheets: Excel, Reagent Preparation
- Assignments
- Report Writing/ Mind maps
- Field Diary
- Digital Catalogue of the Plants of SVV campus

Note: Minimum 75% attendance is mandatory for continuous evaluation.

Field Visits:



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PRACTICAL SKELETON PAPERS SEMESTER V





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T. Y. B. Sc. Botany Semester V
Practical I – Plant Diversity V
(Algae, Fungi and Plant Pathology, Bryophyta)
Skeleton Question Paper

N.B. :

- i) **Candidates should show their slides/ preparations/ results for all questions to the examiner.**

Duration: 2 Hr

Max Marks: 30

Q 1.	Identify, classify, sketch and describe the specimen A, B and C.	15 M
Q 2.	Identify and Describe the specimen/ photomicrograph D and E.	10 M
Q 3.	Journal	05 M



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T. Y. B. Sc. Botany Semester V
Practical II – Plant Diversity VI
(Pteridophytes, Gymnosperms, Taxonomy)
Skeleton Question Paper

N.B. :

- i) Candidates should show their slides/ preparations/ results for all questions to the examiner.

Duration: 2 Hr

Max Marks: 30

Q 1.	Identify, Classify and Describe specimen A and B	12 M
Q 2.	Classify specimen C upto its family giving reasons. Write the floral formula, sketch and label L.S. of flower and T.S. of the ovary.	08 M
Q 3.	Identify and Describe D	05 M
Q 4.	Field Report	05 M



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Practical III – Data Collection and Validation
(Biostatistics and Bioinformatics, Research Methodology, Instrumentation)
Skeleton Question Paper

N.B. :

- i) **Candidates should show their slides/ preparations/ results for all questions to the examiner.**

Duration: 2 Hr

Max Marks: 30

Q 1.	Solve given statistical problems A based on Regression/ Students' t-test/ Probability.	10 M
Q 2.	Perform BLAST analysis B assigned to you.	05 M
Q 3.	Identify and Describe specimen/ photomicrograph C	05 M
Q 4.	Viva-voce	05 M
Q 5.	Journal	05 M



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T. Y. B. Sc. Botany Semester V
Practical IV – Environmental Botany
(Global Environmental Issues, Environmental Health, Environmental Management
Systems and Audit)
Skeleton Question Paper

N.B. :

- i) **Candidates should show their slides/ preparations/ results for all questions to the examiner.**

Duration: 2 Hr

Max Marks: 30

Q 1.	Perform qualitative test A and B for detection of heavy metals.	10 M
Q 2.	Perform given experiment C.	10 M
Q 3.	Viva-voce	05 M
Q 4.	Case study submission	05 M



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T. Y. B. Sc. Botany Semester V
DSEC Practical I – Dietetics
(Nutrition, Meal planning, Food Regulation)
Skeleton Question Paper

N.B. :

- i) **Candidates should show their slides/ preparations/ results for all questions to the examiner.**

Duration: 2 Hr

Max Marks: 30

Q 1.	Perform proximate analysis A of fruit / vegetable / millet.	10 M
Q 2.	Device balanced diet plan B for given target population.	10 M
Q 3.	Identify and Describe C	05 M
Q 4.	Journal	05 M



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DSEC Practical I – Economic Botany
(Agronomy, Industrial crops, Industrial processing of oil)
Skeleton Question Paper

N.B. :

- i) Candidates should show their slides/ preparations/ results for all questions to the examiner.

Duration: 2 Hr

Max Marks: 30

Q 1.	Perform the given experiment A.	10 M
Q 2.	Identify and Describe B, C, D, and E.	16 M
Q 3.	Journal	04 M



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DSEC Practical II – Medicinal Botany
(Monographs of Drugs, Nutrition and Superfoods, Plants as Traditional Medicines)
Skeleton Question Paper

N.B. :

- i) **Candidates should show their slides/ preparations/ results for all questions to the examiner.**

Duration: 2 Hr

Max Marks: 30

Q 1.	Describe macroscopical / microscopical characters with the help of neat and labelled sketches of specimen A. Perform the chemical tests to identify the active constituents.	10 M
Q 2.	Perform given experiment B.	07 M
Q 3.	Identify and Describe the specimen C and D	08 M
Q 4.	Journal	05 M



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T. Y. B. Sc. Botany Semester V
DSEC Practical II – Plant Propagation
(Propagation Practices, Propagation Environment, Pests and Diseases)
Skeleton Question Paper

N.B. :

- i) Candidates should show their slides/ preparations/ results for all questions to the examiner.

Duration: 2 Hr

Max Marks: 30

Q 1.	Demonstrate the propagation practices using given specimen A and B.	10 M
Q 2.	Identify and Describe C and D.	10 M
Q 3.	Viva-voce	05 M
Q 4.	Journal	05 M



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PRACTICAL KEY
SEMESTER V





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T. Y. B. Sc. Botany Semester V

Practical I – Plant Diversity V

(Algae, Fungi and Plant Pathology, Bryophyta)

KEY

Q 1.	A- Algae- <i>Chara</i> , <i>Ectocarpus</i> , <i>Batrachospermum</i> B- Fungi- <i>Pythium</i> , <i>Penicillium</i> , <i>Puccinia</i> C- Bryophyta- <i>Marchantia</i> , <i>Sphagnum</i>	15 M
Q 2.	D- Fungal diseases - Tikka Disease of Groundnut, Rust of wheat, Leaf spot of Rice. E- Slide / specimen of Algae/ Fungi/Bryophyta	10 M
Q 3.	Journal	05 M



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T. Y. B. Sc. Botany Semester V

Practical II – Plant Diversity VI

(Pteridophytes, Gymnosperms, Taxonomy)

KEY

Q 1.	A- Pteridophytes- <i>Lycopodium, Marsilea</i> B- Gymnosperms- <i>Gnetum, Ephedra</i>	12 M
Q 2.	C- Families: Magnoliaceae, Cucurbitaceae, Umbelliferae, Asclepiadaceae, Convolvulaceae, Lamiaceae, Amaranthaceae, Palmae (Aracaceae)	08 M
Q 3.	D- Fossils - <i>Lepidodendron, Lyginopteris, Pentoxylon</i>	05 M
Q 4.	Field Report	05 M



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Practical III – Data Collection and Validation
(Biostatistics and Bioinformatics, Research Methodology, Instrumentation)

KEY

Q 1.	A- Regression/ Student's t-test / Probability	10 M
Q 2.	B- BLAST- pBLAST, nBLAST	05 M
Q 3.	C- Type of rotor	05 M
Q 4.	Viva-voce	05 M
Q 5.	Jornal	05 M



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Practical IV –Environmental Botany
(Global Environmental Issues, Environmental Health, Environmental Management
Systems and Audit)
KEY

Q 1.	A and B- Detection of heavy metals	10 M
Q 2.	C- Ecotypes from polluted and non-polluted areas/ Leaf area index/ Assessment of ambient air pollution based on leaf area/ Stomatal index.	10 M
Q 3.	Viva-voce	05 M
Q 4.	Case study submission	05 M



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T. Y. B. Sc. Botany Semester V

DSEC Practical I – Dietetics

(Nutrition, Meal planning, Food Regulation)

KEY

Q 1.	A- Determination of dry matter and moisture/ Determination of crude fibre/ Determination of soluble proteins.	10 M
Q 2.	B- Infant/ Athlete/ Pregnant Women/ Senior citizen.	10 M
Q 3.	C- Different food groups.	05 M
Q 4.	Journal	05 M



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DSEC Practical I – Economic Botany
(Agronomy, Industrial crops, Industrial processing of oil)
KEY

Q 1.	A- Saponification value of oil sample/ Acid value of edible oil/ Peroxide value of edible oil.	10 M
Q 2.	B- Different varieties of Banana, Grapes, Cashew, Cucumber, Brinjal, Black pepper. C- Different varieties of Banana, Grapes, Cashew, Cucumber, Brinjal, Black pepper. D- By-products of the sugarcane industry. E- Plants as a source of industrial products- Rubber, Sugar, Tea, Oil.	16 M
Q 3.	Journal	04 M



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DSEC Practical II – Medicinal Botany
(Monographs of Drugs, Nutrition and Superfoods, Plants as Traditional Medicines)
KEY

Q 1.	A- <i>Datura innoxia</i> (Leaf), <i>Linum usitatissimum</i> (Seed), <i>Terminalia arjuna</i> (Bark), <i>Asparagus recemosus</i> (Root), <i>Curcuma longa</i> (Rhizome), <i>Tinospora cordifolia</i> (Stem).	10 M
Q 2.	B- Estimation of calcium from Ragi, Fox tail millet, Barnyard millet.	07 M
Q 3.	C- Plant sources for the treatment of following diseases: Anaemia, Diabetes, Hypertension, Cough and Cold. D- Therapeutic value of following plants: Cereals-Milletts (Barley), Pulses- Gram, Pea, Fruits- Amla, Guava.	08 M
Q 4.	Journal	05 M



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T. Y. B. Sc. Botany Semester V
DSEC Practical II – Plant Propagation
(Propagation Practices, Propagation Environment, Pests and Diseases)

KEY

Q 1.	A- Specialised technique – Runner, Corm, Offset, Bulbil, Rhizome. B- Artificial technique – Cutting, Root and Stem cutting	10 M
Q 2.	C- Garden implements D- different media used for soil preparation	10 M
Q 3.	Viva-voce	05 M
Q 4.	Journal	05 M



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PRACTICAL SKELETON PAPERS
SEMESTER VI





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T. Y. B. Sc. Botany Semester VI
Practical I – Applied Botany
(Environmental Microbiology, Applied Microbiology, Biotechnology)
Skeleton Question Paper

N.B. :

- ii) Candidates should show their slides/ preparations/ results for all questions to the examiner.

Duration: 2 Hr

Max Marks: 30

Q 1.	Perform given microbiology experiment A.	10 M
Q 2.	Identify and describe Slide / Specimen / Photomicrograph B and C.	10 M
Q 3.	Report	05 M
Q 4.	Viva-voce	05 M



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T. Y. B. Sc. Botany Semester VI
Practical II – Functional Botany
(Anatomy, Plant Physiology, Seed Technology)
Skeleton Question Paper

N.B. :

- ii) Candidates should show their slides/ preparations/ results for all questions to the examiner.**

Duration: 2 Hr

Max Marks: 30

Q 1.	Make a double stained preparation of T.S. of specimen A and comment on the type of anomalous secondary growth.	08 M
Q 2.	Perform physiology experiment B.	08 M
Q 3.	Identify and Describe specimen C and D.	10 M
Q 4.	Journal	04 M



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T. Y. B. Sc. Botany Semester VI
Practical III – Form and Function II
(Embryology, Palynology, Cytogenetics and Molecular Biology)
Skeleton Question Paper

N.B. :

- ii) Candidates should show their slides/ preparations/ results for all questions to the examiner.

Duration: 2 Hr

Max Marks: 30

Q 1.	Perform given experiment A and B allotted to you.	10 M
Q 2.	Identify and Describe slide / specimen / photomicrograph C and D.	10 M
Q 3.	Viva-voce	05 M
Q 4.	Journal	05 M



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T. Y. B. Sc. Botany Semester VI
Practical IV – Forestry and Biodiversity
(Forest Mensuration, Forest Protection, Biodiversity)
Skeleton Question Paper

N.B. :

- ii) Candidates should show their slides/ preparations/ results for all questions to the examiner.

Duration: 2 Hr

Max Marks: 30

Q 1.	Perform given experiment A.	06 M
Q 2.	Identify and Describe Slide / Specimen / Photomicrograph B, C, D, E.	16 M
Q 3.	Viva-voce	04 M
Q 4.	Journal	04 M



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T. Y. B. Sc. Botany Semester VI
DSEC Practical I – Plant Biotechnology
(Plant Tissue Culture, Micro-Propagation, Nanotechnology and IPR)
Skeleton Question Paper

N.B. :

- ii) Candidates should show their slides/ preparations/ results for all questions to the examiner.

Duration: 2 Hr

Max Marks: 30

Q 1.	Perform given experiment A.	08 M
Q 2.	Identify and describe Slide / Specimen / Photomicrograph B and C.	08 M
Q 3.	Submission of Patent Form / Survey.	04 M
Q 4.	Viva-voce	05 M
Q 5.	Journal	05 M



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(Reaccredited by NAAC with Grade A)
T. Y. B. Sc. Botany Semester VI
DSEC Practical I – Floriculture
(Commercial Floriculture, Breeding of Floral Crops, Cut Flowers and Dry Flowers)
Skeleton Question Paper

N.B. :

- ii) Candidates should show their slides/ preparations/ results for all questions to the examiner.

Duration: 2 Hr

Max Marks: 30

Q 1.	Demonstrate cultivation of given plant material A.	06 M
Q 2.	Perform dry flower arrangement of style B.	06 M
Q 3.	Identify and Describe Slide / Specimen / Photomicrographs C and D.	08 M
Q 4.	Report of Market survey / Report of visit to local florist.	05 M
Q 5.	Journal	05 M



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DSEC Practical II – Alternative Medicine
(Phytochemistry and Pharmacognosy, Conventional Medicine, Ethnobotany)
Skeleton Question Paper

N.B. :

- ii) Candidates should show their slides/ preparations/ results for all questions to the examiner.

Duration:
2 Hr

Max Marks: 30

Q 1.	(a)	Perform phytochemical test for given extract A	04 M
	(b)	Identify the adulterant in given drug B.	04 M
Q 2.	Identify and Describe Slide / Specimen / Photomicrograph C, D and E.		12 M
Q 3.	Field Report		05 M
Q 4.	Journal		05 M



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DSEC Practical II – Green House Technology
(GreenHouse Construction and Economics, GreenHouse Management, Crop Protection
and Marketing)
Skeleton Question Paper

N.B. :

- ii) **Candidates should show their slides/ preparations/ results for all questions to the examiner.**

Duration: 2 Hr

Max Marks: 30

Q 1.	Identify and Describe Slide / Specimen / Photomicrograph A, B, C, D, E, F.	30 M
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PRACTICAL KEY
SEMESTER VI





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T. Y. B. Sc. Botany Semester VI

Practical I – Applied Botany

(Environmental Microbiology, Applied Microbiology, Biotechnology)

KEY

Q 1.	A- COD/ Study of aeromicrobiota by exposed petri-plate method/ MIC of Sugars/ Study of sewage sample by serial dilution.	10 M
Q 2.	B- Types of fermenters C- Ti plasmid	10 M
Q 3.	Report	05 M
Q 4.	Viva-voce	05 M



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T. Y. B. Sc. Botany Semester VI

Practical II – Functional Botany

(Anatomy, Plant Physiology, Seed Technology)

KEY

Q 1.	A- Dicot stem: <i>Bignonia, Aristolochia, Achyranthes</i> , Monocot stem: <i>Dracaena</i> Storage root: <i>Beta vulgaris, Raphanus</i>	08 M
Q 2.	B- Qualitative analysis of respiratory enzymes: Peroxidase, Dehydrogenase, Oxidase/ Seed Viability by TTC method.	08 M
Q 3.	C- Types of stomata D- Seed processing instruments	10 M
Q 4.	Journal	04 M



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Practical III – Form and Function II
(Embryology, Palynology, Cytogenetics and Molecular Biology)
KEY

Q 1.	A- Mounting of embryo-<i>Citrus</i>, <i>Cucurbita</i>, <i>Scoparia</i> and Maize/ pollen viability/ <i>in vivo</i> growth of pollen tube in <i>Portulaca</i>. B- Germination of pollen grains and growth of pollen tube in varying concentrations of sucrose/ airborne pollen grains using gravity slide samplers/ NPC analysis/ Pollen analysis of honey sample.	10M
Q 2.	C- various stages of Microsporogenesis, Megasporogenesis and embryo development D- types of mutation	10M
Q 3.	Viva-voce	05M
Q 4.	Journal	05M



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T. Y. B. Sc. Botany Semester VI

Practical IV – Forestry and Biodiversity

(Forest Mensuration, Forest Protection, Biodiversity)

KEY

Q 1.	A- Measurement of girth, diameter and volume of the plant/ Tree measurement by shadow method.	06 M
Q 2.	B- Instruments required for measurement of individual tree C- Common mangrove plants D- Defects in wood E- Rare and endangered medicinal plants of Western Ghats	16 M
Q 3.	Viva-voce	04 M
Q 4.	Journal	04 M



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DSEC Practical I – Plant Biotechnology
(Plant Tissue Culture, Micro-Propagation, Nanotechnology and IPR)
KEY

Q 1.	A- Preparation of MS media/ Synthesis of silver nano-particles	08 M
Q 2.	B- Layout of laboratory/ Sterilization technique C- Types of Calli/ Hardening of tissue culture plants	08 M
Q 3.	Submission of Patent Form / Survey	04 M
Q 4.	Viva-voce	05 M
Q 5.	Journal	05 M



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KEY

Q 1.	A- Rose, Chrysanthemum, Jasmine	06 M
Q 2.	B- Flower Buckets, Bouquets, Wall Hanging, Greeting Cards	06 M
Q 3.	C- Pot-Pourri D- Cultivation practices not covered in Q.1	08 M
Q 4.	Report of Market survey / Report of visit to local florist.	05 M
Q 5.	Journal	05 M



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KEY

Q 1.	A- Phytochemical tests for Alkaloids/ Tannins/ Phenolics/ Flavonoids/ Glycosides B- Adulterants in drugs- Gulvel starch/ Arjuna bark/ Honey/ Ashoka bark.	08 M
Q 2.	C- Plants of Grandma's pouch D- Novel medicines E- Plants used by tribals for diseases-Jaundice, skin diseases, diarrhoea and dysentery	12 M
Q 3.	Field Report	05 M
Q 4.	Journal	05 M



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KEY

Q 1.	A- Types of Greenhouses. B- Core material/ Covering material. C- Greenhouse Plants D-Greenhouse Plants E- Pests in Greenhouse F- Diseases of Greenhouse plants	30 M
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