M. Sc. (BOTANY) SEMESTER II

Core Course-IV

COURSE TITLE: BRYOPHYTES AND PTERRIDOPHYTES (2001)

COURSE CODE: BO-2001 [CREDITS - 04]

Course Learning Outcome		
After the successful completion of the Course, the learner will be able to: • Govern the concepts of diversity of bryophyte and pteridophytes. • Understand the structural level of plant diversity emphasized in ecological, organizational and cultural. • Realized the fundamental values of diversity and the importance of human welfare. • Define and characterize diversity of lower non vascular and vascular plants to understand the significance of diversity.		
Module 1	**Bryophyte-I**	**[15L]**
Learning Objectives: This module is to designed that • Students will be able to understand the basic structure, cell and tissue properties as characters of bryophytes. • Students will be able to understand the affinities of bryophytes with algae and bryophytes. • Students will be able to understand the applications of bryophytes and pteridophytes.		
Learning Outcome: After the successful completion of the module, the learner will be able to 1. Elaborate knowledge about Bryophyte and will be used to develop skill for identification, importance and applications of bryophyte. 2. To understanding the ecological, cultural and economic importance of bryophytes.		
1.1	➢ Classification of Bryophytes by Rothmaler and Proskauer ➢ Evolution of sporophytes and gametophytes in Bryophytes ➢ Affinities of Bryophytes with fungi and pteridophytes.	[7L]
1.2	➢ Principal characters of following classes (with a note on comparative account) • Hepaticopsida • Anthocerotopsida • Bryopsida	[5L]
1.3	➢ Application of bryophytes in different field.	[3L]
Module 2	**Bryophyte-II**	**[15L]**

Learning Objectives:

This module is intended to:

- Students will be able to understand the classification criteria and important characters of each class
- To acquaint students with bryophyte diversity and its ecological and economic importance.

Learning Outcome:

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

1. Envisage bryophytes as one of the most successful and diverse group of plants that form the pioneering ecosystem
2. Correlate the characters of bryophytes as connecting link between the different groups
3. Understand the journey of plants from water to land, while still retaining some characters of water plants.

2.1	➢ Morphology, Internal structure, reproduction and life cycle of following types: • Plagiochasma • Pellia • Frullania • Porella • Calobryum	[15L]
Module 3	**Pteridophyte – I**	**[15L]**

Learning Objectives:

This module is intended to:

- Learn about the morphology, structure, reproduction and life cycle of different types of Pteridophytes.

Learning Outcome:

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

1. Illustrate diversity among the pteridophytes. General characters of pteridophytes. Classify pteridophytes based on their structure, reproduction and life cycles. Evaluate the ecological, ethnic and economic value of pteridophytes. Summarize their goods and services to human welfare.
2. Evaluate the ecological, ethnic and economic values of pteridophytes.
3. Evolutionary significance of selective method of reproduction.
4. Genetic diversity and its significance

3.1	➢ Diversity and distribution of Indian pteridophytes. ➢ Classification (Wardlow-1955) of Pteridophyte.	[4L]

3.2	➢ Principal characters of following subdivisions. • Psilophytopsida • Psilotopsida • Lycopsida • Sphenopsida • Pteropsida	[6L]
3.3	➢ Affinities of Pteridophytes ➢ Biotechnology- application in pteridophytes. ➢ Pteridophytes as medicines.	[5L]
Module 4	**Pteridophyte –II**	**[15L]**

Learning Objectives:

This module is intended to:

- Illustrate diversity among the pteridophytes, heterospory and seed habit, telome theory.

Learning Outcome:

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

1. Evolution of stellar system of pteridophytes.
2. Learn about apospory and apogamy.

4.1	➢ Heterospory and seed Habit ➢ Telome theory, Enation theory	[5L]
4.2	➢ Stelar system and evolution of stele in Pteridophytes ➢ Apospory and Apogamy	[5L]
4.3	➢ Morphology, Internal structure, reproduction and life cycle of following types: • Lycopodium • Isoetes • Osmunda	[5L]

References:

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Mapping of CLOs and PSOs

Sr. No.	Course Learning Outcomes	Programme Outcomes					
		1	**2**	**3**	**4**	**5**	**6**
1	Classifies bryophyte and pteridophyte based on morphological characters	**X**	**X**				
2	Describes the structure, reproduction of bryophyte	**X**					
3.	Illustrate the structure and reproduction in pteridophyte	**X**	**X**			**X**	
4	Understand the fundamentals of economic importance and biomedical applications of selected species of bryophyte and pteridophyte	**X**	**X**			**X**	
5	Familiarize the use of microscope for identification selected algae and lichen		**X**			**X**	

Question Paper Template

M.Sc. (BOTANY) SEMESTER II

COURSE TITLE: BRYOPHYTES AND PTERIDOPHYTES

COURSE CODE: BO--2001 **[CREDITS - 04]**

Module	Remembering / Knowledge	Understanding	Applying	Analysing	Evaluating	Creating	Total marks
I	8	8			-	-	16
II	6	6	3	3	-	-	18
III	4	4	5	5	-	-	18
IV	4	4	5	5	-	-	18
Total marks per objective	22	22	13	13	-	-	70
% Weightage	31.4%	31.4%	18.6%	18.6%	-	-	100%

M. Sc. (Botany) SEMESTER II

Core Course-V

COURSE TITLE: GYMNOSPERM AND PALEOBOTANY (2002)

COURSE CODE: BO-2002 **[CREDITS - 04]**

Course Learning Outcome		
After the successful completion of the Course, the learner will be able to: • Explain and define the meaning of gymnosperms. • Describe the characteristic features of gymnosperms. • Distinguish and identify the gymnosperms in your surroundings. • Classify the gymnosperms. • Analyze the distribution and economic importance of gymnosperms.		
Module 1	**Gymnosperms**	**[15L]**
Learning Objectives: This module is intended to: • To prove the evolutionary relationship with prehistoric evidences. • Summarize the general characters, classification, and distribution with reference to gymnosperms.		
Learning Outcome: After the successful completion of the module, the learner will be able to 1. Explain economic importance of gymnosperm. 2. Compare gymnosperm with pteridophytes and angiosperms.		
1.1	➢ Recent advances on phylogenomics of gymnosperms and a new classification.	[3L]
1.2	➢ Distribution of Gymnosperms in India. ➢ Affinities of Gymnosperm with pteridophytes and angiosperms.	[6L]
1.3	➢ Origin and evolutionary tendencies in Gymnosperm. ➢ Application of Gymnosperm in different fields.	[6L]
Module 2	**Orders of gymnosperms**	**[15L]**
Learning Objectives: This module is intended to: • Summarize the distinguishing characters of orders of Gymnosperms. • Classify the gymnosperms to respective orders.		
Learning Outcome: After the successful completion of the module, the learner will be able to • Describe the distinguishing characters of orders of gymnosperm.		

2.1	➢ Distinguishing characters of following Orders of Gymnosperms. • Cycadofilicales • Bennettitales • Cycadales • Cordaitales	[8L]
2.2	➢ Distinguishing characters of following Orders of Gymnosperms. • Coniferales • Ginkgoales • Gnetales	[7L]
Module 3	**Life history of gymnosperms**	**[15L]**
Learning Objectives: This module is intended to: • Alternation of generation in gymnosperms. • Distribution, morphology and reproduction of gymnosperms.		
Learning Outcome: After the successful completion of the module, the learner will be able to: 1. Describe the life cycle of Zamia, Ginkgo, Ephedra and Thuja.		
3.1	➢ Classification, distribution, morphology, anatomy, reproduction and life cycle of following types: • Cycadales: Zamia • Ginkgoales: Ginkgo • Ephedrales: Ephedra • Cupressales: Thuja • Welwitschiales: Welwitschia	[15L]
Module 4	**Paleobotany**	**[15L]**
Learning Objectives: This module is intended to: • To consolidate the process of fossilization and principle types of fossils. • Review characters of fossils.		
Learning Outcome: After the successful completion of the module, the learner will be able to: 1. Understand the geological time scale and process of fossilization.		

4.1	➢ Geological Time Scale ➢ Process of Fossilization ➢ Types of fossils ➢ Important Fossils in India	[15L]

References:

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Mapping of CLOs and PSOs

Sr. No.	Course Learning Outcomes	Programme Outcomes					
		1	2	3	4	5	6
1	Discuss the salient features of Gymnosperm morphology	X	X				
2	Illustrate the reproductive characters of important genus of gymnosperm.	X	X				
3.	Explain the significance of Important genus of fossil gymnosperm.	X	X				
4	Classify, structure and reproduction ofthe main classes of gymnosperm.	X	X			X	
5	Develop the Employability skills by learning the application of gymnosperms.						X

Question Paper Template

M.Sc. (BOTANY) SEMESTER II

COURSE TITLE: GYMNOSPERM AND PALEOBOTANY

COURSE CODE: BO-2002 **[CREDITS - 04]**

Module	Remembering / Knowledge	Understanding	Applying	Analysing	Evaluating	Creating	Total marks
I	8	8			-	-	16
II	6	6	3	3	-	-	18
III	4	4	5	5	-	-	18
IV	4	4	5	5	-	-	18
Total marks per objective	22	22	13	13	-	-	70
% Weightage	31.4%	31.4%	18.6%	18.6%	-	-	100%

M. Sc. (BOTANY) SEMESTER II

Core Course-VI

COURSE TITLE: PLANT ANATOMY AND EMBRYOLOGY (2003)

COURSE CODE: BO-2003 [CREDITS - 04]

Course Learning Outcome		
After the successful completion of the Course, the learner will be able to: • Learning about techniques in plant anatomy. • Develop insight in to the structural skeleton of plants.		
Module 1	**Techniques in Plant Anatomy**	**[15L]**
Learning Objectives: This module is intended to: • To learn different techniques of anatomy like sectioning and staining. • To know mounting media and mounting techniques. • To explain the common stains for plant cells.		
Learning Outcome: After the successful completion of the module, the learner will be able to: 1. Understand the different types of anatomical techniques.		
1.1	➢ Introduction ➢ Different types of Techniques- • Epidermal peels • Macerations • Squashes • Free hand Sectioning (Steps in Sectioning, Treatment of Section, Clearing) • Staining • Common Biological Stains • Anatomical drawing • Staining and Permanent Slide Preparation Procedure.	[15L]
Module 2	**Plant anatomy**	**[15L]**
Learning Objectives: This module is intended to:		

- Enable the students to understand the complex tissue structure.
- Knowledge about nodal anatomy.
- Knowledge about seasonal activity of cambium.

Learning Outcome:

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

1. Understand the complex tissue structure, nodal anatomy and cambium activity.

2.1	➢ Structure and components of Xylem ➢ Structure and components of Phloem	[6L]
2.2	➢ Nodal anatomy	[3L]
2.3	➢ Activity of cambium • Normal activity • Seasonal activity	[6L]
Module 3	**Plant embryology- I**	**[15L]**

Learning Objectives:

This module is intended to:

- Knowledge of Sporogenesis and Pollination.
- Learning value- Apomixix and polyembryony.

Learning Outcome:

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

1. Able to understand different types of pollination methods.
2. Control of sexual incompatibility.

3.1	➢ Microsporogenesis. ➢ Megasporogenesis.	[5L]
3.2	➢ Palynology and its significance.	[2L]
3.3	➢ Pollen pistil interaction. ➢ Sexual incompatibility.	[4L]
3.4	➢ Apomixis. ➢ Polyembryony and its applications.	[4L]
Module 4	**Plant embryology- II**	**[15L]**

Learning Objectives:

This module is intended to:

- Knowledge about pollination technique, Fertilization and types of endosperm.

Learning Outcome:

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

1. Able to understand about pollination mechanism, Fertilization and types of endosperm.

4.1	➢ Pollination mechanism • Pre pollination • Post pollination	[6L]
4.2	➢ Double fertilization ➢ Triple fusion	[3L]
4.3	➢ Types of endosperm ➢ Apospory and apogamy	[6L]

References:

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Mapping of CLOs and PSOs

Sr. No.	Course Learning Outcomes	Programme Outcomes					
		1	2	3	4	5	6
1	Remember the various aspects of plant anatomy and embryology	X	X				
2	Understand various concepts of plant anatomy and embryology	X	X				
3.	Apply the theory knowledge gained into practical mode in order to acquire applied knowledge by day-to-day hands-on experiences.	X	X			X	
4	Analyze or interpret the results achieved in practical session in the context of existing theory and knowledge.				X		
5	Evaluate the theory and practical skills gained during the course to make any newmarket value product with cost effective manner.					X	

Question Paper Template

M.Sc. (BOTANY) SEMESTER II

COURSE TITLE: PLANT ANATOMY AND EMBRYOLOGY

COURSE CODE: BO--2003 **[CREDITS - 04]**

Module	Remembering / Knowledge	Understanding	Applying	Analysing	Evaluating	Creating	Total marks
I	8	8			-	-	16
II	6	6	3	3	-	-	18
III	4	4	5	5	-	-	18
IV	4	4	5	5	-	-	18
Total marks per objective	22	22	13	13	-	-	70
% Weightage	31.4%	31.4%	18.6%	18.6%	-	-	100%

M. Sc. (BOTANY) SEMESTER II

ELECTIVE PAPER-II

COURSE TITLE: BIOSTATISTICS AND INSTRUMENTATION

COURSE CODE: BO-EL-2004 [CREDITS - 04]

Course learning outcome		
After the successful completion of the Botany Minor Course, the learner will be able to: • Introduce the various techniques and methods involved in plant science which will enable them to pursue various research activities. • Biostatistics intended to provide the student with a conceptual overview of statistical methods with emphasis on applications commonly used analysis research experiment value. • Topics such as how probability theory explains plant reproduction and how agricultural food is produced will be investigated. • To gain the knowledge about the graphical representation of data, estimation, elementary probability and statistical inference will be covered.		
Module 1	**Biostatistics-1**	**[15L]**
Learning objectives: The module is intended to: • Interpret some common measures of association such as absolute risk, relative risk, and odds ratio. • Demonstrate a good understanding of measures of correlations. • Produce output for multiple linear regression models and interpret their meanings. • Use the statistical tools and apply it to interpret the result.		
Learning outcomes: After the successful completion of the module, the learner will be able to: 1. Understand Biostatistics: introduction, scope and application. 2. Understand types of sampling, variables and its types. 3. Analyze the different type of data using appropriate statistical method. 4. Demonstrate a good understanding of descriptive statistics graphical representation.		
1.1	➢ Biostatistics: Introduction, Scope and Application.	[3L]
1.2	➢ **Types of Sampling**: Random and Stratified Random Sampling.	[3L]
1.3	➢ **Data:** Types (Grouped and Ungrouped Data). ➢ **Variable:** Types (Continuous and Discontinuous, Qualitative and Quantitative).	[5L]
1.4	➢ Graphical representation of data by Histogram, Bar Charts, Pie Charts and Venn diagram.	[4L]
Module 2	**Biostatistics-2**	**[15L]**

Learning objectives:

This module is intended to:

- Master the methods of statistical tests involved in plant science research.
- Understand different type of data using in appropriate statistical method.
- Understand descriptive statistics and graphical tools.

Learning outcome:

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

1. Distinguish between different central tendency based on the research question
2. Understand and interpret commonly reported statistical measures published in plant research.
3. Analyze the different type of data using appropriate statistical method.
4. Demonstrate a good understanding of descriptive statistics and graphical tools.

2.1	➢ **Measures of central tendency** Mean, median and mode	[2L]
2.2	➢ **Measure of dispersion** Dispersion: range, variance, SD, SE and CV.	[4L]
2.3	➢ **Probability and Hypothesis Testing-** Normal Distribution, Confidence Interval and P Value.	[4L]
2.4	➢ **Common Statistical Tools:** Chi-Square, T-Test, ANOVA, Correlation and Regression Analysis; Statistical Packages.	[5L]
Module 3	**Instrumentation –I**	**[15L]**

Learning objectives:

This module is intended to:

- Master good laboratories practice and discipline.
- To utilize safety measures and equipment.
- Objective of the course is to impart knowledge of principle, methodology and application of various techniques & instrumentation.

Learning outcome:

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

1. Understand the principle, instrumentation and working techniques of like colorimeter, centrifugation and mass Spectrophotometry used in botanical research.
2. Evaluate research problem and formulate the methodology for carrying out research/experiment by using instrumental techniques.

3.1	➢ Beer Lambert Law- Spectrophotometer (UV-VIS) and Colorimeter. ➢ Basics of em spectrum, the properties of components of em spectrum. ➢ ELISA and Micro-plate Reader. ➢ Centrifugation. ➢ Mass Spectrophotometry. ➢ Fluorescence spectrophotometry. ➢ Flame (Atomic absorption) spectrophotometry. ➢ Light microscopy (compound microscopy and Phase contrast microscopy). ➢ Fluorescence microscopy. ➢ Transmission and Scanning electron microscopy.	[15L]
Module 4	**Instrumentation–2**	**[15L]**
Learning objectives: This module is intended to: • To get knowledge about the process of chromatography. • To understand and describe different practical methods for performing paper chromatography. • To give examples of mixtures that can be separated using chromatography. • To list examples of uses of chromatography in research field.		
Learning outcome: After the successful completion of the module, the learner will be able to: 1. To understand, define and explain the principle, instrumentation and working of techniques chromatography. 2. To analyze the research problem and formulate the methodology for carrying out Chromatography.		
4.1	➢ **Chromatography:** introduction and history. **Types of chromatography:** • Thin layer chromatography. • Column chromatography. • Ion exchange chromatography. • Molecular sieve chromatography. • Affinity chromatography. • HPLC.	[9L]

	• HPTLC. • Gas Chromatography	
4.2	• Polymerase Chain Reaction, Real Time PCR • Electrophoresis: Types (Agarose Gel Electrophoresis (AGE) and Polyacrylamide Gel Electrophoresis (PAGE))	[6L]

References:

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Mapping of CLOs and PSOs

Sr. No.	Course Learning Outcomes	Programme Outcomes					
		1	2	3	4	5	6
1	Obtain an in-depth knowledge on types of spectrophotometer and techniques in chromatography and electrophoresis.	X	X				
2	Understand the importance of aseptic maintenance in laboratory and culturing techniques in microbes and plants.	X	X				
3.	Calculate the mean, median, mode, standard deviation.	X		X		X	
4	Know the latest version using in statistical tools and apply the tools to interpret the results.	X	X			X	
5	Develop the Employability skills by understanding the ultra-structure of plant organelles, collection and interpretation of data and applications of biostatistics and instrument					X	X

Question Paper Template

M.Sc. (BOTANY) SEMESTER II

COURSE TITLE: BIOSTATISTICS AND INSTRUMENTATION

COURSE CODE: BO-EL-2004 **[CREDITS - 04]**

Module	Remembering / Knowledge	Understanding	Applying	Analysing	Evaluating	Creating	Total marks
I	8	8			-	-	16
II	6	6	3	3	-	-	18
III	4	4	5	5	-	-	18
IV	4	4	5	5	-	-	18
Total marks per objective	22	22	13	13	-	-	70
% Weightage	31.4%	31.4%	18.6%	18.6%	-	-	100%

M. Sc. (BOTANY) SEMESTER II

Skill based Course-I

COURSE TITLE:PHARMACOGNOSY AND PHYTOCHEMISTRY

COURSE CODE:BO-SKL-2005 [CREDITS - 02]

Course Learning Outcome		
After the successful completion of the Course, the learner will be able to: • Basics of pharmacognosy and its importance. • Learn recent advances in pharmacognosy of plants drugs. Methods to identify and isolate the phytoconstituents from such plants and establish its activity.		
Module 1	**Pharmacognosy**	**[15L]**
Learning Objectives: This module is intended to: • Microscopic method of pharmacognostic analysis. • Learn about plants phytoconstituents and methods to isolate them to carryout qualitative and quantitative analysis. • Gain knowledge about pharmaceutical adjuvants of plant origin. • Understand concept of Ethno-medicine and their pharmacognostic standard to monitor crude drugs.		
Learning Outcome: After the successful completion of the module, the learner will be able to: 1. Identify, isolate and characterize the constituents against. 2. Introduce to basic principles of Ayurveda. 3. How to develop method of standardization of crude as well as prepared drugs.		
1.1	➢ Introduction of Pharmacognosy: Definition, history, scope and development of Pharmacognosy. ➢ Alternative system of medicine: AYUSH (Ayurveda, Unani, Siddha and Homeopathy).	[3L]
1.2	➢ Sources of Drugs – Plants, Animals, Marine & Tissue culture. ➢ Organized drugs, unorganized drugs (dried latex, dried juices, dried extracts, gums andmucilage, oleoresins and oleo- gum -resins).	[4L]
1.3	➢ Cultivation and harvesting practices of herbal plants.	[5L]

	➢ Good manufacturing practices.	
1.4	➢ Scenario of trade in Indian medicinal and aromatic Plants (global and local scenario). ➢ Drug Adulteration: Definition, types and reasons with examples.	[3L]
Module 2	**Phytochemistry**	**[15L]**
Learning Objectives: This module is intended to: • Learn about the importance of phytochemicals present in plants. • Provide knowledge of extraction method of phytochemical. • Understand methods of identification and evaluation, phytochemicals present in plants and their medicinal properties.		
Learning Outcome: After the successful completion of the module, the learner will be able to: 1. Learn about Phytochemistry of the plants. 2. Possess knowledge of quantitative microscopy for quality control of herbal drugs. 3. Understand the physical evaluation of crude drugs. 4. Acquire knowledge of morphological and microscopic characteristics of crude drugs.		
2.1	➢ Definition, Sources, Classification, Biosynthesis of: • Alkaloids. • Tannins. • Glycosides. • Flavonoids.	[4L]
2.2	➢ Volatile Oils, Essential oils and fixed oil- Extraction methods and uses. ➢ Extraction, Isolation & Purification of herbal drugs.	[3L]
2.3	➢ **Phytochemicals of the following:** • **Underground parts**: *Asparagus racemosus, Chlorophytum borivilianum* , *Withania somnifera* • **Bark:** *Terminalia arujuna, Saraca asoca, Crataeva nurvala.* • **Leaf:** *Leptadenia reticulata, Cassia angustifolia*, *Eclipta alba.* • **Flowers:** *Madhuca indica, Calotropis procera.*	[4L]

2.4	**Phytochemicals of the following:** • **Seeds:** *Plantago ovata*, *Trigonella foenumgraecum, Strychnos nux-vomica.* • **Whole Plant**: *Andrographis paniculata, Enicostema axillare, Bacopa monnieri.* • **Exudates:** *Papaver somniferum*, *Commiphora wightii, Sterculia urens.* • **Wood:** *Santalum album, Pterocarpus marsupium.* • **Oil:** *Ricinus communis, sesamum indicum.*	[4L]

References:

- W.C.Evans, Trease and Evans Pharmacognosy, 16th edition, W.B. Sounders & Co.,London, 2009.
- Tyler, V.E., Brady, L.R. and Robbers, J.E., Pharmacognosy, 9th Edn., Lea andFebiger, Philadelphia, 1988.
- Text Book of Pharmacognosy by T.E. Wallis.
- Mohammad Ali. Pharmacognosy and Phytochemistry, CBS Publishers &Distribution, New Delhi.
- Text book of Pharmacognosy by C.K. Kokate, Purohit, Gokhlae (2007), 37th Edition,Nirali Prakashan, New Delhi.
- Herbal drug industry by R.D. Choudhary (1996), Ist Edn, Eastern Publisher, NewDelhi.
- Essentials of Pharmacognosy, Dr.SH.Ansari, IInd edition, Birla publications, NewDelhi, 2007.
- Practical Pharmacognosy: C.K. Kokate, Purohit, Gokhlae.
- Anatomy of Crude Drugs by M.A. Iyengar.

Mapping of CLOs and PSOs

Sr. No.	Course Learning Outcomes	Programme Outcomes					
		1	2	3	4	5	6
1	Understood the process quantitative microscopy for quality control of herbal drugs	X	X				
2	Aware physical evaluation of crude drugs	X	X				
3.	Acquire knowledge of morphological and microscopic characteristics of crude drugs and apply it for identification and standardization			X		X	
4	Determine different extractive and ash values as per pharmacopeial requirements .				X	X	
5	Develop the employability skills by understanding pharmacognocy and phytochemistry				X		X

Question Paper Template

M.Sc. (BOTANY) SEMESTER II

COURSE TITLE: 1 PHARMACOGNOCY AND PHYTOCHEMISTRY

COURSE CODE: BO-SKL-2005 **[CREDITS - 02]**

Module	Remembering/ Knowledge	Understanding	Applying	Analysing	Evaluating	Creating	Total marks
I	6	6	2	2	-	-	16
II	5	5	2	2	-	-	14
Total marks per objective	11	11	04	04	-	-	30
% Weightage	36.7%	36.7%	13.3%	13.3%	-	-	100%

M. Sc. (Botany) SEMESTER II

Skill based Course

COURSE TITLE: GARDENING

COURSE CODE: BO-SKL-2005 [CREDITS - 02]

Course Learning Outcome		
After the successful completion of the Course, the learner will be able to: • To learn about importance, history, development, types of garden and garden components. • To learn about landscaping principles, lawn making.		
Module 1	**Gardening**	**[15L]**
Learning Objectives: This module is intended to: • Learn about the importance of gardening, landscaping, terrace and kitchen gardening. • Learn about the indoor plants.		
Learning Outcome: After the successful completion of the module, the learner will be able to: 1. Develop skill about garden design.		
1.1	➢ History and importance of gardening.	[2L]
1.2	➢ **Principles and methods of designing**: Outdoor garden (hedges, edges, fences, trees, climber, Lawns, rockeries, arches, terrace garden and vertical garden) ➢ **Lawn**- Making and maintenance ➢ **Water garden**- cultivation of water plants. ➢ Layout for a model institutional garden.	[10L]
1.3	➢ Decoration with indoor plants for conference hall, living room, dining hall and verandah.	[3L]
Module 2	**Components of garden**	**[15L]**
Learning Objectives: This module is intended to: • To impart knowledge about garden plant component and execution of private garden.		

Learning Outcome: After the successful completion of the module, the learner will be able to ; • Know about different types of ornamental plants and flower decoration. • Start their startups as an employer and self-employment.		
2.1	➢ **Garden Plant components:** Arboretum, flowering annuals and herbaceous perennials-Climbers and creepers-Ornamental palms-Ferns.	6L
2.2	➢ **Execution of private garden:** Public garden and factory garden.	2L
2.3	➢ **Indoor gardening:** Foliage plants, flowering plants, hanging basket, Bonsai plants- Training and pruning. ➢ Flower decoration- Dry and wet decoration.	7L
References: • Gopal Samy Iyengar,1990, Complete Gardening In India, IBH, India • Indoor gardening, Vishnu Swarup, ICAR, New Delhi. • Nambison K.M.P 1992 Design elements of Landscape gardening. Publication, New Delhi. • Pratibha and P. Trivedi, 1990 Beautiful shrubs, ICAR, New Delhi		

Mapping of CLOs and PSOs

Sr. No.	Course Learning Outcomes	Programme Outcomes					
		1	2	3	4	5	6
1	Understand the scope and importance of gardening	X	X				
2	Aare with the weed and diseases Management for gardening	X					
3.	Apply tool and technique for home gardening successful growth and production of plants.	X	X			X	
4	Understand the basics gardening tools, equipment and watering.	X	X				
5	providing self-employment to the learner with the knowledge gardening						X

Question Paper Template

M.Sc. (BOTANY) SEMESTER II

COURSE TITLE: GARDENING

COURSE CODE: BO-SKL-2005 **[CREDITS - 02]**

Module	Remembering/ Knowledge	Understanding	Applying	Analysing	Evaluating	Creating	Total marks
I	6	6	2	2	-	-	16
II	5	5	2	2	-	-	14
Total marks per objective	11	11	04	04	-	-	30
% Weightage	36.7%	36.7%	13.3%	13.3%	-	-	100%

M.Sc. (BOTANY) SEMESTER II

(Practical)

COURSE TITLE: Practical based on Core paper IV to VI

COURSE CODE: BOP-2006 [Credit- 06]

Course Learning Outcome
After the successful completion of the Course, the learner will be able to: 1. Demonstrate practical skills. 2. Correlate their Botany theory concepts through practical. 3. Develop an understanding different diversity of plants.

Module: 1	Bryophytes and pteridophytes	[60h]

1	Study of morphology, classification, reproduction using preserved specimen and permanent slides of *Plagiochasma*
2	Study of morphology, classification, reproduction using preserved specimen and permanent slides of *Pellia.*
3	Study of morphology, classification, reproduction using preserved specimen and permanent slides of *Frullinia.*
4	Study of morphology, classification, reproduction using preserved specimen and permanent slides of *porella.*
5	. Study of morphology, classification, reproduction using preserved specimen and permanent slides of *Calobryum.*
7	Study of morphology, classification, reproduction using preserved specimen and permanent slides of *Lycopodium*
8	Study of morphology, classification, reproduction using preserved specimen and permanent slides of *Isoetes*
9	Study of morphology, classification, reproduction using preserved specimen and permanent slides of *Adiantum*
10	Study of morphology, classification, reproduction using preserved specimen and permanent slides of *Salvinia*
11	Study of morphology, classification, reproduction using preserved specimen and permanent slides of *Ophioglossum*
12	Study of morphology, classification, reproduction and life-cycle of *Pteris/Dryopteris (as per availability)*

Module 2	Gymnosperm and Paleobotany	[60hr]

1	**A.** Study of classification and morphology of preserve/fresh material of Zamia. **B.** Study of reproduction using preserves/fresh material of Zamia. **C.** Study of Permanent slides of Zamia.
2	**A.** Study of classification and morphology of preserve/fresh material of Ginkgo. **B.** Study of reproduction using preserves/fresh material of Ginkgo. C.Study of permanent slides of Ginkgo.
3	**A.** Study of classification and morphology of preserve/fresh material of Ephedra. **B.** Study of reproduction using preserves/fresh material of Ephedra. **C.** Study of permanent slides of Ephedra
4	**A.** Study of classification and morphology of preserve/fresh material of Thuja. **C.** Study of reproduction using preserves/fresh material of Thuja. **D.** Study of permanent slides of Thuja.
5	Study of following fossils as per availability: 1. Rhynia 2. Calamites 3. Sphenophyllum 4. Lyginopteris 5. Stigmaria 6. Pterophyllum

Module: 3	Plant anatomy and Embryology	[60 hr]

1	To study different types of stomata from the given plant material.
2	To study different types of hairs/trichomes from the given plant material.

3	To prepare permanent slides from given stems by double staining methods (Secondary growth).
4	To prepare permanent slides from given stems by double staining methods (Anomalous Secondary growth)-*Nyctanthes.*
5	To prepare permanent slides from given stems by double staining methods (Anomalous Secondary growth)-*Salvadora.*
6	To prepare permanent slides from given stems by double staining methods (Anomalous Secondary growth)- *Tinospora.*
7	To prepare permanent slides from given stems by double staining methods (Anomalous Secondary growth)- *Boerhavia.*
8	Study of various types of Xylem Elements in wood by maceration techniques.
9	To study heartwood and sapwood using specimen or charts.
10	To study ring porous and diffuse porous wood from slide or charts.
11	To study Autumn wood and Spring wood using specimen or charts.
12	Histochemical study to find out various metabolites like Starch, Lipid, Suberin, Tanin, Lignin.
13	Study of Raphides, Spheraphides, Cystolith in the plants.
14	To study latex gland, latex cells, Oil gland, Lipids, Resin ducts of plants.
15	To Study microsporangia and megasporangia.
16	To Study pollen grain germination.

17	To study Pollen morphology of different families.
18	To measure the pollen and pollen tube using micrometry.
19	To study effect of time on pollen germination.
20	To study effect of chemical concentration on pollen germination.

- Every candidate shall complete laboratory course in accordance with the regulations issued from time to time by Academic Council on the recommendation of the Board of Studies.
- Every candidate shall record observation directly in the laboratory journal. Every journal shall be signed periodically.
- At the end of the semester candidate shall produce certified journal during the practical examination.