

**SOPHIA GIRLS' COLLEGE,  
AJMER  
(AUTONOMOUS)**



**SYLLABUS**

**(Batch)  
2018-19**

**FOR**

**BACHELOR OF SCIENCE**

**Semester – I to VI**

# BACHELOR OF SCIENCE

Eligibility for admission in First Year of B Sc. is 10+2 examination of any board with at least 50% marks. As regards admission on reserved category seats government rules will be applicable.

## SCHEME OF EXAMINATION

The number of paper and the maximum marks for each paper together with the minimum marks required for a pass are shown against each subject separately. It will be necessary for a candidate to pass in the theory part as well as the practical part of a subject/paper, wherever prescribed, separately.

Classification of successful candidates shall be as follows:

First Division	60%	of the aggregate marks prescribed at Part I Examination, Part II Examination, Part III Examination, taken together
Second Division	48%	

All the rest shall be declared to have passed the examination.

1. For passing a candidate shall have to secure at least 40% marks in each course (Theory and practical separately).
2. No division shall be awarded at the Part I and Part II examination.
3. Due paper(s) will be applicable if a candidate fails in not more than three (3) papers (theory,). Due paper(s) will be held along with the examination of the next semester. The chance of due paper(s) will be given only 4 times.
4. Wherever a candidate appears at for a due paper examination he/she will do so according to the syllabus in force at the time of her admission.
5. A candidate not appearing at any examination/absent in any paper of term end examination shall be deemed as fail.

## End Semester Examination Pattern

**Maximum Marks : 50**

**Duration : 2 ½ Hrs.**

### **Section A**

Contains 10 Questions of 1 mark each & all are compulsory to do.

10 \* 1 = 10 marks

Three questions from each unit (but 4 questions from one unit)

3 + 3 + 4 = 10 Questions

### **Section B**

Contains 3 questions with internal choice ( Two questions from each unit).

(2 Questions of 3 marks & 1 Question of 4 marks )

Student has to do 3 questions and at least one question from each unit.

3+3+4 = 10 marks

### **Section C**

Contains 3 questions with internal choice (Two questions from each unit).

Each Question carries 10 marks.

Student has to do 3 questions and at least one question from each unit.

3 \* 10 = 30 marks

## End Semester Practical Examination Pattern

**Maximum Marks : 40**

**Duration : 3 Hrs.**

### **Note:**

1. A Laboratory Exercise File should be prepared by each student for each practical paper and should be submitted during practical examinations.
2. One internal and one external examiner shall conduct two practical exams, in a day, of a batch of 60 students.
3. Duration of practical exam is 3 hours.
4. Practical of 40 marks distribution is as under:

Distribution of Marks for Practical:

Experiments: = 20 marks, Spots = 08 marks, Viva Voce: = 07 marks,

Record: =05 marks, Lab. Work= 10\* marks

Teaching & Examination Scheme for  
Bachelor of Science (2018-19 Batch)

<b>Semester - I</b>					
<b>Theory Papers</b>	<b>Internal</b>	<b>External</b>	<b>Max. Marks</b>	<b>Min. Marks</b>	<b>Duration</b>
B. Sc. – 101 Algae, Fungi and Lichens	25	50	75	30	2 ½ Hr.
B. Sc. – 102 Microbiology and Plant Pathology	25	50	75	30	2 ½ Hr.
<b>Practical Paper</b>					
B. Sc. – 103 Practicals	10	40	50	20	3 Hr.
<b>Total</b>			<b>200</b>	<b>80</b>	
<b>Semester – II</b>					
<b>Theory Papers</b>	<b>Internal</b>	<b>External</b>	<b>Max. Marks</b>	<b>Min. Marks</b>	<b>Duration</b>
B. Sc. – 201 Bryophytes and Pteridophytes	25	50	75	30	2 ½ Hr.
B. Sc. – 202 Cell Biology	25	50	75	30	2 ½ Hr.
<b>Practical Paper</b>					
B. Sc. – 203 Practicals	10	40	50	20	3 Hr.
<b>Total</b>			<b>200</b>	<b>80</b>	

## Bachelor of Science (2018-19 Batch)

<b>Semester - III</b>					
<b>Theory Papers</b>	<b>Internal</b>	<b>External</b>	<b>Max. Marks</b>	<b>Min. Marks</b>	<b>Duration</b>
B. Sc. – 301 Anatomy of Angiosperms	25	50	75	30	2 ½ Hr.
B. Sc. – 302 Taxonomy of Angiosperms	25	50	75	30	2 ½ Hr.
<b>Practical Paper</b>					
B. Sc. – 303 Practicals	10	40	50	20	3 Hr.
<b>Total</b>			<b>200</b>	<b>80</b>	
<b>Semester – IV</b>					
<b>Theory Papers</b>	<b>Internal</b>	<b>External</b>	<b>Max. Marks</b>	<b>Min. Marks</b>	<b>Duration</b>
B. Sc. – 401 Diversity of Seed Plants	25	50	75	30	2 ½ Hr.
B. Sc. – 402 Reproduction in Flowering Plants	25	50	75	30	2 ½ Hr.
<b>Practical Paper</b>					
B. Sc. – 403 Practicals	10	40	50	20	3 Hr.
<b>Total</b>			<b>200</b>	<b>80</b>	

Teaching & Examination Scheme for  
Bachelor of Science (2018-19 Batch)

<b>Semester - V</b>					
<b>Theory Papers</b>	<b>Internal</b>	<b>External</b>	<b>Max. Marks</b>	<b>Min. Marks</b>	<b>Duration</b>
B. Sc. – 501 Plant Physiology and Biochemistry	25	50	75	30	2 ½ Hr.
B. Sc. – 502 Development and utilization of Plants	25	50	75	30	2 ½ Hr.
<b>Practical Paper</b>					
B. Sc. – 503 Practicals	10	40	50	20	3 Hr.
<b>Total</b>			<b>200</b>	<b>80</b>	
<b>Semester – VI</b>					
<b>Theory Papers</b>	<b>Internal</b>	<b>External</b>	<b>Max. Marks</b>	<b>Min. Marks</b>	<b>Duration</b>
B. Sc. – 601 Plant Ecology	25	50	75	30	2 ½ Hr.
B. Sc. – 602 Genetics and Biotechnology of Plants	25	50	75	30	2 ½ Hr.
<b>Practical Paper</b>					
B. Sc. – 603 Practicals	10	40	50	20	3 Hr.
<b>Total</b>			<b>200</b>	<b>80</b>	

# **SEMESTER - I**



**Sophia Girls' College, Ajmer (Autonomous)**  
**B. Sc. Semester – I (2018-19 Batch)**

**Max. Marks : 75(Ext:50, Int:25)**  
**Time : 2 ½ Hrs**

**Min. Marks: 30**

**BOT 101: ALGAE, FUNGI AND LICHENS**

**OBJECTIVE:**

To educate the students about the diversity of algae, fungi and lichens. It will help to appreciate the diversity of life forms, phylogenetic relationship, ecology and economic importance.

**Unit I**

**Algae-** General characters, Thallus organisation, Pigments, Reserve food material, Classification (Fritsch), Economic importance, Algal bloom and Types of life cycle.

**A General account of lichens.**

**Unit II**

**Important features and life history of:** Cyanophyceae- *Nostoc*, *Oscillatoria*

Chlorophyceae- *Volvox*, *Oedogonium*

Xanthophyceae- *Vaucheria*

Phaeophyceae- *Ectocarpus*

Rhodophyceae- *Polysiphonia*

**Unit III**

**Fungi-** General characters, Classification (Alexopolous & Mims, 1979), Economic importance, Heterothallism, Parasexuality.

**Important features and life history of:**

Mastigomycotina- *Phytophthora*

Zygomycotina- *Mucor*

Ascomycotina- *Eurotium*, *Peziza*

Basidiomycotina- *Puccinia*, *Agaricus*

**REFERENCE BOOKS :**

1. Smith, G.M. 1971. Cryptogamic Botany. Vol. I Algae and fungi. Tata McGraw Hill Publishing Co. New Delhi.
2. Sharma, O.P. 1992. Text Book of Thallophytes. Mc Graw Hill Pub.Co.
3. Sharma, P.D. 1991. The Fungi. Rastogi and Co., Meerut
4. Dube, H.C. 1990. An introduction to Fungi. Vikas Pub. House Pvt. Ltd. Delhi.
5. Gilbert, Smith, M. 1985. Cryptogamic Botany, Vol. I & II (2<sup>nd</sup> edition) Tata McGraw Hill Publishing Co. New Delhi.

**Sophia Girls' College, Ajmer (Autonomous)**  
**B. Sc. Semester – I (2018-19 Batch)**

**Max. Marks : 75(Ext:50, Int:25)**

**Min. Marks: 30**

**Time : 2 ½ Hrs**

**BOT 102: MICROBIOLOGY AND PLANT PATHOLOGY**

**OBJECTIVE:**

Studying microbiology will be helpful in knowing the structure and nature of micro-organisms. Plant pathology is relevant in understanding how and why various crops are attacked by insects and pests (fungi, bacteria and viruses) and how to minimize the economic effect on commercial crops by these pathogens.

**Unit I**

**Classification of living world** (Whittakar's five kingdom classification)

**Bacteria-** structure, reproduction (Binary fission, transformation, conjugation & transduction). Gram staining, economic and biological importance.

**General features of:** Rickettsias, Archaeobacteria and Actinomycetes.

**Unit II**

**Virus-** Structure, multiplication and transmission of virus (TMV & Bacteriophage)

**Mycoplasma-** structure and economic importance. Phytoplasma, Little leaf of brinjal  
Infection of plants by bacteria and fungi

A general account of diseases caused by plant pathogens<sup>1</sup>:

**Bacterial diseases-** Citrus canker, Tundu disease of wheat

**Viral disease-** Tobacco mosaic

**Unit III**

Host parasite interaction, Important symptoms of plant diseases caused by fungi.

Disease cycle and control of:

**Fungal diseases-** White rust of crucifers, Green year disease of bajra, Loose Smut of wheat, Red rot of sugarcane, Tikka disease of groundnut

**REFERENCE BOOKS:**

1. Clifton, A. 1985. Introduction of the Bacteria. Mc Graw Hill & Co. New York
2. Bilgrami, K.S. and Dube, H.C. 2000. A text book of Modern Plant Pathology, Vikas Pub. New Delhi
3. Biswas, S.B. and Biswas, A. 2000. An introduction to virus, Vikas Pub. New Delhi.
4. Mandahar, C.L. 1978. Introduction to Plant Viruses, Chand & Co. Ltd., New Delhi.
5. Rangaswamy, G. and Mahadevan, A. 1999. Diseases of Crop Plants in India (4<sup>th</sup> edition), Printice Hall of India Pvt. Ltd., New Delhi.

**Sophia Girls' College, Ajmer (Autonomous)**  
**B. Sc. Semester – I (2018-19 Batch)**

**Max. Marks : 50(Ext:40, Int:10)**  
**Time : 3 Hrs**

**Min. Marks: 20**

**BOT –103 Practicals**

**NOTE:**

**Distribution of Marks:**  
**Experiments: = 20 marks, Spots = 08 marks, Viva Voce: = 07 marks,**  
**Record: =05 marks, Lab. Work= 10\***

**SUGGESTED LABORATORY EXERCISES:**

1. Study of genera included under algae and fungi.
2. Observation of disease symptoms in hosts infected by fungi, viruses, bacteria and Mycoplasma.
3. Section cutting of diseased material.
4. Gram's staining of bacteria.
5. Study of crustose, foliose and other types of lichen thalli.

# **SEMESTER - II**

**Sophia Girls' College, Ajmer (Autonomous)**  
**B. Sc. Semester – II (2018-19 Batch)**

**Max. Marks : 75(Ext:50, Int:25)**

**Min. Marks: 30**

**Time : 2 ½ Hrs**

**BOT 201: Bryophytes and Pteridophytes**

**OBJECTIVE:**

Study of bryophytes will help the students to understand their role as pioneers in plant communities. Pteridophytes (ferns) have been the subject of research for their ability to remove some chemical pollutants from the air. Some are significant weeds and also play a role in mythology and medicine. Studying pteridophytes will enrich the knowledge of students about them.

**Unit - I**

**Bryophytes-** General characters, Classification, Economic and Ecological importance.

Structure and reproduction in:

**Hepaticopsida-** *Marchantia*

**Anthocerotopsida-** *Anthoceros*

**Bryopsida-** *Funaria*

**Unit II**

**Pteridophytes-** General characters, Classification, Stellar system.

**Important characteristics of:** Psilophyta, Lycophyta, Sphenophyta and Pterophyta.

**Unit III**

**Structure and reproduction in:** *Rhynia*, *Lycopodium*, *Selaginella*, *Equisetum*, *Pteris* and *Marsilea*

**REFERENCE BOOKS:**

1. Smith, G.M. 1971. Cryptogamic Botany. Vol. II Bryophytes and Pteridophytes. Tata McGraw Hill Pub. Co. New Delhi.
2. Sharma, O.P. Text book of Pteridophyta. McMillan India Ltd.
3. Puri, P. 1980. Bryophyta. Atma Ram and sons Delhi
4. Vashishta, B.R. 2002. Botany for Degree Students. S.Chand and Co. New Delhi.
5. Vashishta, P.C. 2002. Pteridophytes. S.Chand and Co. New Delhi.

**Sophia Girls' College, Ajmer (Autonomous)**  
**B. Sc. Semester – II (2018-19 Batch)**

**Max. Marks : 75(Ext:50, Int:25)**

**Min. Marks: 30**

**Time : 2 ½ Hrs**

**BOT 202: Cell Biology**

**OBJECTIVE:**

To introduce the students with cell structure and function of cell and cell organelles. The content of this paper is designed to provide students with a background of chromosome organisation, structure & function of DNA and cell division.

**Unit-I**

**Structure of Prokaryotic and Eukaryotic cell.**

**The cell envelopes:** structure and function of Plasma membrane and Cell wall.

**Structure and function of cell organelles:** Golgi body, Endoplasmic reticulum, Peroxisome, Vacuole, Mitochondria, Chloroplast, Ribosome and Centriole

**Unit-II**

**Nucleus:** Structure and function of Nucleus and Nucleolus.

**Chromosome organisation:** Structure, Euchromatin and Heterochromatin

**Chromosomal alterations:** Structural changes in Chromosomes (Deletion, Duplication, Translocation and Inversion), Numerical Changes in Chromosomes: [Aneuploidy (Monosomy, Nullisomy, Trisomy, and Tetrasomy), Euploidy (Monoploidy and Polyploidy)]

**Unit-III**

**DNA:** Structure, Types (A, B, C and Z), Replication and DNA-protein interaction (Nucleosome Model) Genetic code, Satellite and Repetitive DNA

**Cell cycle:** Steps, Regulation and control

**Cell division:** Mitosis and Meiosis, Significance.

**REFERENCE BOOKS:**

1. Alberts, B., Bray, D., Lewis J. Raff., M., Roberts K. & Watson I. D.1999. Molecular Biology of Cell. Garland Pub., Co. Inc. New York, U.S.A.
2. Gupta, P.K. 1999. A text book of Cell and Molecular biology. Rastogi Pub. Meerut, New Delhi.
3. Kleinsmith, L.J. and Kish. V.M.1995. Principles of Cell and Molecular Biology (2<sup>nd</sup> edition). Harper Collins College Pub., New York. U.S.A.
4. Wolfe, S.L. 1993. Molecular and Cellular Biology. Wadsworth Pub. Co., California U.S.A.

**Sophia Girls' College, Ajmer (Autonomous)**  
**B. Sc. Semester – II (2018-19 Batch)**

**Max. Marks : 50(Ext:40, Int:10)**  
**Time : 3 Hrs**

**Min. Marks: 20**

**BOT- 203 PRACTICALS**

**NOTE:**

**Distribution of Marks:**

**Experiments: = 20 marks, Spots = 08 marks, Viva Voce: = 07 marks,**

**Record: =05 marks, Lab. Work= 10\*marks**

**SUGGESTED LABORATORY EXERCISES:**

1. Study of morphology, reproductive structures and anatomy of the examples cited in the theory under Bryophyta and Pteridophyta.
2. To study the cell structure from onion peels, demonstration of staining and mounting method
3. Comparative study of cell structure in onion cells, Hydrilla and Spirogyra.
4. Study of plastids to examine pigment distribution in plants (e.g. Cassia, Lycopersicon and Capsicum).
5. Examination of electron micrographs of eukaryotic cells with special reference to organelles.
6. Examination of electron micrographs of viruses, bacteria, cyanobacteria and eukaryotic cells for comparative cellular organisation.
7. Examination of various stages of mitosis and meiosis using appropriate plant material (e.g. root tips and flower buds of onion).

# **SEMESTER - III**



**Sophia Girls' College, Ajmer (Autonomous)**  
**B. Sc. Semester – III (2018-19 Batch)**

**Max. Marks : 75(Ext:50, Int:25)**

**Min. Marks: 30**

**Time : 2 ½ Hrs**

**BOT 301: Anatomy of Angiosperms**

**OBJECTIVE:**

It focuses on plant structure at the light microscope level with the major goals of understanding the structure common to all vascular plants and the developmental processes that yield mature anatomy.

**Unit - I**

**The basic body plan of a flowering plant** – Modular type of growth

**The shoot system:** Shoot apical meristem and its histological organization, Structure of primary shoot in monocotyledons and dicotyledons.

**The root system:** Root apical meristem, Differentiation of primary and secondary tissues and their roles, Structural modification for storage, respiration, reproduction and for interaction with microbes.

**Unit II**

Cambium and its functions, Formation of secondary xylem, A general account of wood in relation to conduction of water and minerals, Characteristics of growth rings, Sap wood and heart wood, Secondary phloem: structure and function, Periderm. Anomalous growth: primary (*Triticum*, *Nyctanthes*) and secondary (*Salvadora*, *Bignonia*, *Dracaena*)

**Unit III**

**Leaf:** Origin and development, Internal structure in relation to photosynthesis and water loss, Adaptations to water stress, Senescence and abscission.

**REFERENCE BOOKS:**

1. Cutter, E.G. 1969. Part I. Cells and Tissues. Edward Arnold, London.
2. Esau, K. 1977. Anatomy of Seed Plants, 2<sup>nd</sup> edition. John Wiley & Sons, New York.
3. Fahn, A. 1974. Plant Anatomy, 2<sup>nd</sup> edition. Pergamon Press, Oxford.
4. Mauseth, J.D. 1988. Plant Anatomy. The Benjamin/ Cummings Pub. Co., Inc. Menlo Park, California, U.S.A.

**Sophia Girls' College, Ajmer (Autonomous)**  
**B. Sc. Semester – III (2018-19 Batch)**

**Max. Marks : 75(Ext:50, Int:25)**

**Min. Marks: 30**

**Time : 2 ½ Hrs**

**BOT 302: Taxonomy of Angiosperms**

**OBJECTIVE:**

It includes important aspects of plant classification and important families of plants. Taxonomic work is of fundamental importance in the study of biodiversity and conservations.

**Unit-I**

**Angiosperm taxonomy:** Brief history, Aims and fundamental concepts (alpha taxonomy, omega taxonomy, holotaxonomy), Taxonomic literature, Herbarium technique, Important herbaria and Botanical gardens of India.

**Botanical nomenclature:** Principal and rules, Salient features of International Code of Botanical Nomenclature, Taxonomic ranks, Type concept, Principle of priority, Major contribution of cytology, Phytochemistry and Taxometrics to taxonomy.

**Unit-II**

**Classification of Angiosperms:** Salient features of systems proposed by Bentham & Hooker, Engler&Prantl.

**Diversity of flowering plants as illustrated by members of families:** Ranunculaceae, Cruciferae, Malvaceae, Rutaceae, Fabaceae, Apiaceae, andCompositae.

**Unit-III**

**Diversity of flowering plants as illustrated by members of families:** Acanthaceae, Apocyanaceae, Asclepiadaceae, Solanaceae, Labiatae, Euphorbiaceae, Liliaceae and Poaceae.

**REFERENCE BOOKS:**

1. Davis, P.H. and Heywood, V.H. 1973. Robert E. Kreiger Pub. Co., New York.
2. Heywood, V.H. and Moore, D.M. (eds) 1984. Current Concepts in Plant Taxonomy. Academic Press. London.
3. Jeffrey, C. 1982. An Introduction to Plant Taxonomy. Cambridge University Press. Cambridge, London.
4. Jones, S.B., Jr. and Luchsinger, A.E. 1986. Plant Systematics (2<sup>nd</sup> edition). McGraw Hill Book Co., New York.
5. Radord, A.E. 1986. Fundamentals of Plant Systematics. Harper and Row. New York.

**Sophia Girls' College, Ajmer (Autonomous)**  
**B. Sc. Semester – III (2018-19 Batch)**

**Max. Marks : 50(Ext:40, Int:10)**

**Min. Marks: 20**

**Time : 3 Hrs**

**BOT: 303 Practicals**

**NOTE:**

**Distribution of Marks:**

**Experiments: = 20 marks, Spots = 08 marks, Viva Voce: = 07 marks,**

**Record: =05 marks, Lab. Work= 10\* marks**

**SUGGESTED LABORATORY EXERCISES:**

1. Study of commonly occurring dicotyledonous plants (eg. Solanumnigrum or Kalanchoe) to understand the body plan and modular type of growth.
2. Life forms exhibited by flowering plants (by a visit to a forest or a garden). Study of tree like habit in Cycads, bamboos, banana, travellers tree (*Revenalamadagascariensis*) or Yucca and comparison with true trees as exemplified by conifers and dicotyledons.
3. L.S. shoot tip to study the cytohistological zonation origin of leaf primordium.
4. Anatomy of primary and secondary growth in monocots and dicots using hand sections (or prepared slides). Structure of secondary phloem and xylem. Growth rings in wood. Microscopic study of wood in T.S., T.L.S. and R.L.S.
5. Internal structure of leaf. Structure and development of stomata (using epidermal peels of leaf).
6. Anatomy of root. Primary and secondary structure, Anomalous growth.
7. Angiosperms

The following species are suitable for study. The list is only indicative. Teachers may select plants available in their locality.

- i. **Ranunculaceae:** *Ranunculus, Delphinium*
- ii. **Cruciferae:** *Brassica, Alyssum, Iberis, Coronopus*
- iii. **Malvaceae:** *Hibiscus, Abutilon*
- iv. **Rutaceae:** *Murraya, Citrus*
- v. **Fabaceae :** Faboideae: *Lathyrus, Cajanus, Melilotus, Trigonella;*  
**Caesalpinioideae:** *Cassia, Caesapinia;* Mimosoideae: *Prosopis, Mimosa, Acacia*
- vi. **Umbelliferae:** *Coriandrum, Foeniculum, Anethum*
- vii. **Compositae:** *Tridax, Parthenium, Sonchus*
- viii. **Acanthaceae:** *Adhatoda, Peristrophe*
- ix. **Apocyanaceae:** *Vinca, Thevetia, Nerium*
- x. **Asclepiadaceae:** *Calotropis*
- xi. **Solanaceae:** *Solanum, Withania, Datura*
- xii. **Euphorbiaceae:** *Euphorbia, Phyllanthus*
- xiii. **Labiatae:** *Ocimum, Salvia*
- xiv. **Liliaceae:** *Asphodelous, Asparagus*
- xv. **Poaceae:** *Avena, Triticum, Hordeum, Poa, Sorghum*

# **SEMESTER – IV**

**Sophia Girls' College, Ajmer (Autonomous)**  
**B. Sc. Semester – IV (2018-19 Batch)**

**Max. Marks : 75(Ext:50, Int:25)**

**Min. Marks: 30**

**Time : 2 ½ Hrs**

**BOT 401: Diversity of Seed Plants**

**OBJECTIVE:**

This paper attempts to include important aspects of living and fossil gymnosperms. It encompasses distribution, morphology, anatomy and reproductive biology of gymnosperms.

**Unit - I**

**Characteristics of seed plants:** Evolution of seed habit, Seed plants with fruits (Angiosperms) and without fruit (Gymnosperms).

**Angiosperms:** Origin and Evolution, Some examples of primitive Angiosperms (*Magnolia*, *Degeneria*, *Trochodendron*, *Dryims*)

**Unit II**

**Gymnosperms:** General characteristics, Classification, Geological time scale, Fossilisation and some examples of fossil gymnosperms (*Lyginopteris*, *Glossopteris*, *Ptilophyllum*, *Williamsonia*, *Cycadeoidea*)

**Unit III**

**Morphology of vegetative & reproductive parts and Anatomy of:** root, stem and leaf, reproductive parts and life cycle of *Cycas*, *Pinus* and *Ephedra*.

**REFERNCE BOOKS:**

1. Bhatnagar, S.P. and Moitra, A. 1996. Gymnosperms. New Age International Ltd., New Delhi.
2. Gifford, E.M and FASTER, A.S. 1988. Morphology and Evolution of Vascular Plants. W.H. Freeman & Company, New York.
3. Sporne, K.R. 1965. The Morphology of Gymnosperms. Hutchinson & Co. (Pub.) Ltd., London.
4. Stewart, W.M. 1983. Palaeobotany and the Evolution of Plants. Cambridge University Press, Cambridge.

**Sophia Girls' College, Ajmer (Autonomous)**  
**B. Sc. Semester – IV (2018-19 Batch)**

**Max. Marks : 75(Ext:50, Int:25)**

**Min. Marks: 30**

**Time : 2 ½ Hrs**

**BOT 402: Reproduction in Flowering Plants**

**OBJECTIVE:**

This paper explains the basic laws of origin of and development of generative and embryological structures (sporogenesis, gametogenesis and embryogenesis).

**Unit - I**

**Flower:** Structure, Types of anther and pistil.

**Male gametophyte:** Structure of anther, Microsporogenesis, Role of tapetum, Pollen germination and growth of pollen tube.

**Female gametophyte:** Structure and types of ovule, Megasporogenesis, Organisation of embryo sac.

**Unit II**

Types of pollination, Pollen-pistil interaction, Self incompatibility, Double fertilization, Endosperm, Embryogenesis.

**Unit III**

**Methods of Vegetative propagation.**

**Latent life-Dormancy:** Importance and types of seed dormancy, overcoming seed dormancy. Parthenocarpy, Types of fruits

**REFERENCE BOOKS:**

1. Bewley, J.D. and Black, M. 1994. Seeds: Physiology of Development and Germination. Plenum Press, New York.
2. Bhojwani, S.S. and Bhatnagar, S.P. 2000. The Embryology of Angiosperms (4<sup>th</sup> revised and enlarged edition). Vikas Pub. House, New Delhi.
3. Fageri, K. and Van der Pijl 1979. The Principles of Pollination Ecology. Pergamon Press, Oxford.
4. Hartmann, H.T. and Kestler, D.E. 1976. Plant Propagation: Principles and Practices (3<sup>rd</sup> edition). Printice Hall of India Pvt. Ltd., New Delhi.
5. Proctor, M. and Yeo, P. 1973. The Pollination of Flowers. William Collins Sons, London.

## B. Sc. Semester – IV (2018-19 Batch)

Max. Marks : 50(Ext:40, Int:10)

Min. Marks: 20

Time : 3 Hrs

### BOT: 403 Practicals

#### NOTE:

Distribution of Marks:

Experiments: = 20 marks, Spots = 08 marks, Viva Voce: = 07 marks,

Record: =05 marks, Lab. Work= 10\* marks

#### SUGGESTED LABORATORY EXERCISES:

##### 1. Gymnosperms:

###### a. *Cycas*

- i. Habit, armour of leaf bases on stem (if specimen is not available show photograph), very young leaf (circinate vernation) and old foliage leaves, scale leaf, bulbils, male cone (specimen), microsporophyll, megasporophyll, mature seed.
- ii. Study through permanent slides – normal root (T.S.), stem (T.S.) (if specimens are not available show photographs), ovule (L.S.)
- iii. Study through hand sections or dissections – coralloid root (T.S.), rachis (T.S.), leaflet (V.S.), microsporophyll (V.S.), pollen grains (W.M.)

###### b. *Pinus*

- i. Habit, long and dwarf shoot showing cataphylls and scale leaves, T.S. wood showing growth rings, male cone, female cone (1<sup>st</sup> year, 2<sup>nd</sup> year and 3<sup>rd</sup> year), winged seeds.
- ii. Study through permanent slides – root (T.S.), female cone (L.S.), ovule (L.S.), embryo (W.M.) showing polycotyledonous condition.
- iii. Study through hand sections or dissections – young stem (T.S.), old stem (T.L.S. and R.L.S.), needle (T.S.), male cone (L.S.), male cone (T.S.), pollen grain (W.M.).

###### c. *Ephedra*

- i. Habit and structure of whole male and female cones.
  - ii. Permanent slides – female cone (L.S.).
  - iii. Study through hand sections or dissections – node (L.S.), internode (T.S.), macerated stem to see vessel structure, epidermal peel mount of vegetative parts to study stomata, male cone (T.S. and L.S.), pollen grains.
2. Examination of a wide range of flowers available in the locality and methods of their pollination.
  3. Structure of anther, microsporogenesis (using slides) and pollen grains (using whole mounts). Pollen viability using in-vitro pollen germination.
  4. Structure of ovule and embryo sac development (using serial sections).
  5. Nuclear and cellular endosperm. Embryo development in monocots and dicots (using slides/dissections).
  6. Simple experiments to show vegetative propagation (leaf cuttings in Bryophyllum, Sansevieria, Begonia, stem cuttings in- rose, Salix, money plant, sugarcane and Bougainvillea).
  8. Germination of non-dormant and dormant seeds.

# **SEMESTER - V**



**Sophia Girls' College, Ajmer (Autonomous)**  
**B. Sc. Semester – V (2018-19 Batch)**

**Max. Marks : 75(Ext:50, Int:25)**

**Min. Marks: 30**

**Time : 2 ½ Hrs**

**BOT 501: Plant Physiology and Metabolism**

**OBJECTIVE:**

To introduce students with fundamental concepts of plant physiology and biochemistry within a framework of histological origins and modern approaches. It includes various aspects of plant lifestyles and survival including metabolism, water relation, growth, development etc.

**Unit - I**

**Plant-water relations:** Importance of water to plant life, Physical properties of water, diffusion and osmosis, Absorption, transport of water, Transpiration: physiology of stomata.

**Transport of organic substances:** Mechanism of phloem transport, Source-sink relationship.

**Basics of enzymology:** Discovery, Nomenclature, Characteristics, Concept of holoenzyme, apoenzyme, coenzyme and cofactors, Mechanism of action, Michaelis-Menten equation and its significance, Regulation of enzyme activity.

**Unit II**

**Photosynthesis:** Significance, historical aspects, Pigments, Light harvesting complexes, Absorption and action spectra, Enhancement effect, Concept of two photosystems, Z-scheme, Photophosphorylation, Calvin cycle, C<sub>4</sub> pathway, CAM plants, Photorespiration.

**Respiration:** ATP-the biological energy currency, Aerobic and anaerobic respiration, Krebs's cycle, Electron transport mechanism (chemi-osmotic theory), Oxidative phosphorylation, Pentose phosphate pathway.

**Unit III**

**Mineral nutrition:** Essential macro- and micro-elements, their role, Deficiency and toxicity symptoms

**Nitrogen metabolism:** Biology of nitrogen fixation, Importance of nitrate reductase and its regulation, Ammonia assimilation.

**Lipid metabolism:** Structure and function of lipids, Fatty acid biosynthesis,  $\beta$ -oxidation, Storage and mobilization of fatty acids.

**REFERENCE BOOKS:**

1. Buchanan, B.B., Gruissem, W. and Jones, R.L. 2000. Biochemistry and Molecular Biology of Plants. American Society of Plant Physiologists, Maryland, USA.
2. Hopkins, W.G. 1995. Introduction to Plant Physiology. John Wiley & Sons, Inc., New York, USA.
3. Lea, P.J. and Leegood, R.C. 1999. Plant Biochemistry and Molecular Biology. John Wiley & Sons, Chichester England.
4. Salisbury, F.B. and Ross, C.W. 1992. Plant Physiology (4<sup>th</sup> edition). Wadsworth Pub. Co., California, USA.
5. Taiz, L. and Zeiger, E. 1998. Plant Physiology (2<sup>nd</sup> edition). Sinauer Associates, Inc., Pub., Massachusetts, USA.

**Sophia Girls' College, Ajmer (Autonomous)**  
**B. Sc. Semester – V (2018-19 Batch)**

**Max. Marks : 75(Ext:50, Int:25)**

**Min. Marks: 30**

**Time : 2 ½ Hrs**

**BOT 502: Development and Utilization of Plants**

**OBJECTIVE:**

Students will get to know the role of various plant hormones in regulating vital functions in plants. Economic botany will provide knowledge on the utility of plant species, cultivated or in wild stage.

**Unit - I**

**Growth and development:** Definitions, Phases of growth and development, Growth kinetics

**Photoperiodism:** Florigen concept. Vernalization

**Photomorphogenesis:** Phytochrome- discovery, Physiological role, Mechanism of action, HIR (High Irradiance Response)

**Unit II**

**Plant hormones:** Discovery, Structure, Bioassay, Physiological role and Application of; Auxin, Gibberellin, Cytokinin, Abscisic acid and Ethylene.

**Unit III**

**Utilization of Plants:**

**Food Plants:** Rice, Wheat, Maize, Sugarcane

**Fibers:** Cotton and Jute

**Vegetable oils:** Groundnut, Mustard and Coconut

**Spices:** General account (Black pepper, Cloves, Cinnamon, Cardamom, Turmeric, Coriander)

**Medicinal Plants:** General account (Atropa, Serpentine, Brahmi, Ashwagandha)

**Beverages:** Tea and Coffee

**Rubber**

**REFERENCE BOOKS:**

1. Moore, T.C. 1989. Biochemistry and Physiology of Plant Hormones (2<sup>nd</sup> edition). Springer-Verlag, New York, USA.
2. Sambamuthy, A.V.S.S. and Subramanyam, N.S. 1989. A Text Book of Economic Botany. Wiley Easter Delhi.
3. Sharma, O.P. 1996. Hill's Economic Botany (Late Dr. A.F. Hill, adapted by O.P. Sharma). Tata McGraw Hill, New Delhi.
4. Simpson, B.B. and Conner-Ogorzaly, M. 1986. Economic Botany- Plants in Our World. McGraw Hill, New Delhi.
5. Thomas, B. and Vince-Prue, D. 1997. Photoperiodism in Plants (2<sup>nd</sup> edition). Academic Press, San Diego, USA.

**Sophia Girls' College, Ajmer (Autonomous)**  
**B. Sc. Semester – V (2018-19 Batch)**

**Max. Marks : 50(Ext:40, Int:10)**

**Min. Marks: 20**

**Time : 3 Hrs**

**BOT: 503 Practicals**

**NOTE**

**Distribution of Marks:**

**Experiments: = 20 marks, Spots = 08 marks, Viva Voce: = 07 marks,**

**Record: =05 marks, Lab. Work= 10\* marks**

**SUGGESTED LABORATORY EXERCISES:**

1. To study the permeability of plasma membrane using different concentrations of organic solvent.
2. To study the effect of temperature on permeability of plasma membrane.
3. Separation of chlorophyll pigments by paper chromatography.
4. To study the phenomenon of plasmolysis using *Tradescantia/Rhoeo discolor* leaves.
5. To demonstrate unequal transpiration in dorsiventral leaves using cobalt chloride paper.
6. To observe the effect of different wavelengths of light on photosynthesis using Wilmott's bubbler.
7. To demonstrate osmosis using potato osmoscope.
8. To study the enzyme activity of catalase and peroxidase as influenced by pH and temperature.
9. Introduction and demonstration of instruments: pH meter, colorimeter, centrifuge etc.
10. Phytochemical tests for starch, cellulose, protein, fats, lignin, and anthocyanin.
11. Comparison of the rate of respiration of various plant parts.
12. Utilization of plants:
  - a. **Food Plants:** Rice, Wheat, Maize, Sugarcane
  - b. **Fibers:** Cotton and Jute
  - c. **Vegetable oils:** Groundnut, Mustard and Coconut
  - d. **Spices:** Black pepper, Cloves, Cinnamon, Cardamom
  - e. **Medicinal Plants:** any 10 used in indigenous system of medicines
  - f. **Beverages:** Tea and Coffee.
  - g. **Rubber**

# **SEMESTER – VI**

**Sophia Girls' College, Ajmer (Autonomous)**  
**B. Sc. Semester – VI (2018-19 Batch)**

**Max. Marks : 75(Ext:50, Int:25)**

**Min. Marks: 30**

**Time : 2 ½ Hrs**

**BOT 601: Plant Ecology**

**OBJECTIVE:**

To introduce the students that how the Earth's systems function. Understanding how food webs and trophic levels work. It will help to study the relationship between organisms and their environment.

**Unit - I**

**Environment:** Atmosphere (gaseous composition), Water (properties of water cycle), Light (global radiation and photosynthetically active radiation), Temperature, Soil (development, soil profiles, physico-chemical properties)

**Unit II**

**Morphological, anatomical and physiological adaptations of plants to water:** hydrophytes, xerophytes and halophytes

**Population ecology:** Growth curves, Ecotypes, Ecads. Types of species Interaction.

**Community ecology:** Characteristics, Characters (analytical and synthetic), Biological spectrum, Ecological succession, concept of climax, Ecological niche.

**Unit III**

**Ecosystems:** Structure- abiotic and biotic components, food chain, food web, ecological pyramids, energy flow,

**Biogeochemical cycles** of-carbon, nitrogen and phosphorous.

**Biogeographical regions of India.**

**Vegetation types of India:** Forests and grasslands.

**REFERENCE BOOKS:**

1. Chapman, J.L. and Reiss, M.J. 1998. Ecology: Principles and Applications. Cambridge University Press, Cambridge, U.K.
2. Odum, E.P. 1983. Basic Ecology. Saunders, Philadelphia.
3. Koromondy, E.J. 1996. Concepts of Ecology. Printice-Hall of India Pvt. Ltd., New Delhi.
4. Mackenzie, A. et al. 1999. Instant Notes in Ecology. Viva Books Pvt. Ltd., New Delh

**Sophia Girls' College, Ajmer (Autonomous)**  
**B. Sc. Semester – VI (2018-19 Batch)**

**Max. Marks : 75(Ext:50, Int:25)**  
**Time : 2 ½ Hrs**

**Min. Marks: 30**

**BOT 602: Genetics and Biotechnology of Plants**

**OBJECTIVE:**

Study of genetics will help the students to understand how genes function and how characters are inherited from one generation to the next. The concept of biotechnology encompasses a wide range of procedures for modifying living organisms according to human purposes.

**Unit - I**

**Genetic inheritance:** Mendelism, Laws of segregation and independent assortment, Linkage analysis, Tetrad analysis, Allelic and non-allelic interactions

**Gene expression:** Gene concept, Transfer of genetic information-transcription, translation, Regulation of gene expression in prokaryotes and eukaryotes

**Unit II**

**Genetic variations:** Mutations-spontaneous and induced, DNA damage & repair

**Genetic engineering:** Tools and techniques of recombinant DNA technology, Cloning vectors, Genomic and cDNA library, Transposable elements, Polymerase Chain Reaction, Gene mapping and chromosome walking

**Unit III**

**Biotechnology:** Definition, Basic aspects of plant tissue culture-cellular totipotency, differentiation, morphogenesis, Somatic hybridization-protoplast isolation, fusion and culture, Artificial seed, Biology of *Agrobacterium*, Vectors for gene delivery and vectorless gene transfer, Marker and reporter genes, Salient achievements in crop biotechnology

**REFERENCE BOOKS:**

1. Bhojwani S.S. 1990. Plant Tissue Culture: Applications and Limitations. Elsevier Science Pub., New York, USA.
2. Brown, T.A. 1999. Genomes. John Wiley & Sons (Asia) Pvt. Ltd., Singapore.
3. Henry, R.J. 1997. Practical Application of Plant Molecular Biology. Chapman & Hall, London, UK.
4. Vasil, I.K. and Thorpe, T.A. 1994. Plant Cell and Tissue Culture. Kluwer Academic Pub., The Netherlands.

**Sophia Girls' College, Ajmer (Autonomous)**  
**B. Sc. Semester – VI (2018-19 Batch)**

**Max. Marks : 50(Ext:40, Int:10)**

**Min. Marks: 20**

**Time : 3 Hrs**

**BOT: 603 Practicals**

**NOTE**

**Distribution of Marks:**

**Experiments: = 20 marks, Spots = 08 marks, Viva Voce: = 07 marks,**

**Record: =05 marks, Lab. Work= 10\* marks**

**SUGGESTED LABORATORY EXERCISES:**

1. To determine minimum size of quadrats required for phytosociological studies.
2. To determine frequency of herbaceous species by quadrat method.
3. To determine density of herbaceous flora by quadrat method.
4. Soil analysis: soil texture, soil moisture, soil pH
5. To estimate bulk density and porosity of grassland and woodland soil
6. To determine water holding capacity of grassland and woodland soil.
7. Water analysis:
  - a. To estimate pH, temperature and transparency of different water bodies.
  - b. To demonstrate the presence of carbonate and chloride in different water samples.
8. Ecological instruments and their working: oven and maximum-minimum thermometer.
9. Plant adaptive modifications, specimen/slides: *Opuntia*, *Euphorbia*, *Capparis*, *Casuarina*, *Hydrilla* etc
10. Introduction to Instruments/Techniques, Laminar Air Flow/Sterile Bench, Autoclave.
11. Preparation of culture media for tissue culture- MS Media, Nutrient Agar, PDA media.
12. Demonstration of inoculation technique, aseptic transfer of explant and microbial transfer technique.
13. Demonstration of the technique of micro-propagation by using different explants e.g. Axillary bud, shoot meristem.
14. Demonstration of the technique of anther culture.
15. Isolation of protoplast from different tissues by using commercially available enzymes.
16. Numerical problems based on genetics and gene mapping