# GOVERNMENT COLLEGE (AUTONOMOUS), KALABURGI

## DEPARTMENT OF STUDIES & RESEARCH IN

# BOTANY

## NATIONAL EDUCATION POLICY- 2020

## (NEP-2020)

## B.Sc. BOTANY: Semester - 1

### Title of the Course: MICROBIAL DIVERSITY AND TECHNOLOGY

| Number of Theory Credits | Number of lecture hours/semester | Number of practical Credits | Number of practical hours / semester |
|---|---|---|---|
| 4 | 56 | 2 | 56 |

| Content of Theory Course 1 | 56 Hrs |
|---|---|
| **Unit –1** | 15 |
| **Chapter No. 1: MICROBIAL DIVERSITY-**<br>Introduction to microbial diversity; Methods of estimation; Hierarchical organization and positions of microbes in the living world. Whittaker's five-kingdom system and Carl Richard Woese's three-domain system. Distribution of microbes in soil, air, food and water. Significance of microbial diversity innature. | 5 |
| **Chapter No. 2 HISTORY AND DEVELOPMENTS OF MICROBIOLOGY-**<br>Microbiologists and their contributions **(**Leeuwenhoek, Louis Pasteur, Robert Koch, Joseph Lister, Dmitri Iwanowski, Sergius Winogradsky and M W Beijerinck and PaulEhrlich**).** | 5 |
| **Chapter No. 3 MICROSCOPY-**<br>Working principle and applications of light, dark field, phase contrast and electron microscopes (SEM and TEM). Microbiological stains (acidic, basic and special) and Principles of staining. Simple, Gram's and differential staining. | 5 |

| | |
|---|---|
| **Unit – 2** | 15 |
| **Chapter No. 4. CULTURE MEDIA FOR MICROBES**<br>Natural and synthetic media, Routine media -basal media, enriched media, selective media, indicator media, transport media, and storagemedia. | 5 |
| **Chapter No. 5. STERILIZATION METHODS -**<br>Principle of disinfection, antiseptic, tyndallisation and Pasteurization,<br>**Sterilization-**Sterilization by dry heat, moist heat, UV light, ionization radiation, filtration. Chemical methods of sterilization-phenolic compounds, anionic and cationic detergents. | 5 |
| **Chapter No. 6. MICROBIAL GROWTH**<br>Microbial growth and measurement. Nutritional types of Microbes- autotrophs and heterotrophs, phototrophs and chemotrophs; lithotrophs and organotrophs. | 5 |
| **Unit – 3** | 11 |
| **Chapter No. 7 MICROBIAL CULTURES AND PRESERVATION-**<br>Microbial cultures. Pure culture and axenic cultures, subculturing, Preservation methods- overlaying cultures with mineral oils, lyophilisation. Microbial culture collections and their importance. A brief account on ITCC, MTCC and ATCC. | 5 |
| **Chapter No. 8. VIRUSES-**<br>General structure and classification of Viruses; ICTV system of classification. Structure and multiplication of TMV, SARS-COV-2, and Bacteriophage (T2). Cultivation of viruses. Vaccines and types. | 4 |
| **Chapter No. 9.VIROIDS-**<br>General characteristics and structure of Potato Spindle Tuber Viroid (PSTVd); Prions - general characters and Prion diseases**.** Economic importance of viruses. | 2 |

| | |
|---|---|
| **Unit – 4** | 15 |
| **Chapter No. 10. BACTERIA-**<br>General characteristics and classification. Archaebacteria and Eubacteria. Ultrastructure of Bacteria; Bacterial growth and nutrition. Reproduction in bacteria-asexual and sexual methods. Study of *Rhizobium* and its applications. A brrief account of Actinomycetes and Cyanobacteria. Mycoplasmas and Phytoplasmas-Generalcharacteristics and diseases. Economic importance ofBacteria. | 5 |
| **Chapter No. 11. FUNGI-**<br>General characteristics and classification. (Alexopoulus 1962)Thallus organization and nutrition in fungi. Reproduction in fungi (asexual and sexual). Heterothallism and parasexuality. Type study of *Phytophthora,Rhizopus,, Penicillium* and *Trichoderma***.** | 5 |
| **Chapter No.12. LICHENS –**<br>Structure, types and reproduction.<br>**VAM Fungi** and their significance.<br>**Plant diseases**-Late Blight of Potato, Black stem rust of wheat; Downy Mildew of Bajra, Grain smut of Sorghum, Sandal Spike, Citrus Canker, Root Knot Disease of Mulberry. Economic importance ofFungi. | 5 |

**Text Books**


1. Ananthnarayan R and Panikar JCK. 1986. Text book of Microbiology. Orient Longman ltd. New Delhi.
2. Arora DR. 2004. Textbook of Microbiology, CBS, New Delhi.
3. William CG. 1989. Understanding microbes. A laboratory text book for Microbiology. W.H. Freeman and Company. New York.
4. Dubey RC and Maheshwari DK. 2007. A textbook of Microbiology, S. Chand and Company, New Delhi.
5. Dubey RC and Maheshwari DK. 2002. A Text book of Microbiology, S.C. Chand and Company, Ltd. Ramnagar, New Delhi.
6. Sharma R. 2006. Text book of Microbiology. Mittal Publications. New Delhi.305pp.
7. Sharma PD. 1999. Microbiology and Plant Pathology. Rastogi publications. Meerut, India.
8. Vasanth kumari R. 2007. A textbook of Microbiology, BI Publications Pvt. Ltd., New Delhi.


# References


1. Alexepoulos CJ and Mims CW. 1989. Introductory Mycology, Wiley Eastern Ltd., New Delhi.
2. Allas RM. 1988. Microbiology: Fundamentals and Applications, Macmillan publishing co. New York.
3. Brook TD, Smith DW and Madigan MT. 1984. Biology of Microorganisms, 4th ed. Eaglewood Cliffts. N.J.Prentice- Hall. New Delhi.
4. Burnell JH and Trinci APJ. 1979. Fungal walls and hyphal growth, Cambridge University Press. Cambridge.
5. JayaramanJ.1985.Laboratory Manual of Biochemistry, Wiley Eastern Limited. New Delhi.
6. Ketchum PA. 1988. Microbiology, concepts and applications. John Wiley and Sons. New York..
7. MichelJ, PelczarJ. EC and Krieg CR. 2005. Microbiology, Mc.Graw-Hill, New Delhi.

8. Powar CB and Daginawala. 1991. General Microbiology, Vol – I and Vol – II Himalaya publishing house, Bombay.
9. Reddy S and Ram. 2007. Microbial Physiology. Scientific Publishers, Jodhpur, 385pp.
10. Sullia SB and Shantharam S. 1998. General Microbiology. Oxford and IBH publishing Co.Pvt.Ltd. New Delhi.
11. Schlegel HG. 1986. General Microbiology. Cambridge. University Press. London, 587pp.
12. Roger S, Ingrahan Y, Wheelis JL, Mark L and Page PR. 1990. Microbial World 5th edition. Prentice-Hall India, Pvt. Ltd. New Delhi.
13. Sullia SB. and Shantharam S. 2005. General Microbiology, Oxford and IBH, New Delhi.

# Pedagogy:

Lectures, Practicals,Field and laboratory visits, Participatory Learning, Seminars, Assignments, specimen submission etc.

| **Formative Assessment** | |
|---|---|
| **Assessment Occasion/ type** | **Weightage in Marks** |
| I TEST | 15 |
| II TEST | 15 |
| ASSIGNMENT | 10 |
| **Total** | 40 |

**Date** **Course Co-ordinator** **Subject Committee Chairperson**

# PRACTICALS:

## Content of Practical Course 1: List of Experiments to be conducted

**Practical** 1: Safety measures in microbiology laboratory and study of equipment/appliances used for microbiological studies (Microscopes, Hot air oven, Autoclave/Pressure Cooker, Inoculation needles/loop, Petri plates, Incubator, Laminar flow hood, Colony counter, Haemocytomer, Micrometer etc).

**Practical 2**: Enumeration of soil/food /seed microorganisms by serial dilution technique.

**Practical 3:** Preparation of culture media (NA/PDA) sterilization, inoculation, incubation of*E coli / B. subtilis/* Fungi and study of cultural characteristics.

**Practical 4:** Determination of cell count by using Haemocytometer and determination microbial cell dimension by using Micrometer.

**Practical 6:** Simple staining of bacteria (Crystal violet /Nigrosine blue) / Gram's staining of bacteria.

**Practical 7:** Isolation and study of morphology of *Rhizobium* from root nodules of legumes

**Practical 8:** Preparation of spawn and cultivation of paddy straw (Oyster) mushroom.

**Practical 9:** Study of vegetative structures and reproductive structures - Albugo,Phytophthora/Pythium, Rhizopus/Mucor, Saccharomyces, Neurospora/ Sordaria,Puccinia, Agaricus, Lycoperdon, Aspergillus/Penicillium, Trichoderma.(Perform Maximum type study Depending on local availability)

**Practical 10:** Preparation of agar slants, inoculation, incubation, pure culturing and preservation of microbes by oil overlaying.

**Practical 11:** Study of late blight of Potato, Downy mildew of Bajra, Citrus canker, Tobacco mosaic disease, Sandal spike disease.

**Practical 12:** Study of well-known microbiologists and their contributions through charts and photographs.

**Practical-13:** Visit to water purification units/Composting/ microbiology labs/dairy and farms to understand role of microbes in day today life.

**(Note: Botanical study tour to a floristic rich area for 1-2 days and submission of study report is compulsory)**

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# DEPARTMENT OF STUDIES & RESEARCH IN BOTANY

## B.Sc I Semester (NEP-2020) Practical Examinations

**Course code.BOT- 1.2.1 ( Course type-DSCC) MICROBIAL DIVERSITY AND TECHNOLOGY**

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

| | |
|---|---|
| Q1. Identify, classify and write the salient features observed of specimen A, B, C & D | 12 Marks |
| Q2. Perform minor experiment 'E'. Show the preparation to the examiners. | 06 Marks |
| Q3. Identify the specimen and critically comment on F and G | 08 Marks |
| Q4. Identify and describe the features observed in the slides/specimen H, I, J and K | 08 Marks |
| Q5. Viva voce | 05Marks |
| Q6. Submission/s | |
| i. Study Tour Report | 06 Marks |
| ii. Practical Record | 05 Marks |
| **Total** | **50 marks** |

Note: The total marks obtained by the candidate is converted to 25 marks (50/2=25.if he/she obtained 40/2=20 marks)

## B.Sc. Semester – I

# THEORY EXAMINATION

## GENERAL PATTERN OF THEORY QUESTION PAPER FOR DSCC/ OEC

**Time: 3 hrs** **60 Marks**

**Part-A**

Question number 1-7 carries 2 marks each. Answer any 5 questions : 10marks

**Part-B**

Question number 08- 13 carries 05 Marks each. Answer any 4 questions : 20 marks

**Part-C**

Question number /14-18 carries 10 Marks each. Answer any 03 questions : 30 marks

**Total: 60 Marks**

**Note: 1. Minimum 1 question from each unit and 10 marks question may have sub questions for 7+3 or 6+4 or 5+5 if necessary)**

**Note: 2. Proportionate weight-age shall be given to each unit based on number of hours prescribed.**

## B.Sc. BOTANY: Semester – 2

**Title of the Course: Diversity of Non- Flowering Plants**

| Number of Theory Credits | Number of lecture hours/semester | Number of practical Credits | Number of practical hours/semester |
|---|---|---|---|
| 4 | 56 | 2 | 56 |

| Content of Theory Course 2 | 56Hrs |
|---|---|
| **Unit –1** | 15 |
| **Chapter No. 1**<br>A general account of Blue-green and algae. Algal blooms and toxins. Historical development in algology. Classification of algae (Fritch's). - Habitat, thallus organization, pigments, reserve food, flagella types, life-cycle and alternation of generation in Algae. | 5 |
| **Chapter No. 2** Morphology and reproduction and life-cycles of Nostoc, *Oedogonium*, *Chara*, *Sargassum* and *Batrachospermum*. Diatoms and their importance. | 5 |
| **Chapter No. 3** Algal cultivation- Cultivation of microalgae-*Spirulina* and Algal cultivation methods in India. Algal products- Food and Nutraceuticals, Feed stocks, food colorants; fertilizers, aquaculture feed; therapeutics and cosmetics; medicines; dietary fibres from algae and uses. | 5 |
| **Unit – 2** | 15 |

| | |
|---|---|
| **Chapter No. 4.** Bryophytes – General characteristics and classification of Bryophytes (Sporne) thallus structure, Gametophytes and sporophytes. | 5 |
| **Chapter No. 5 M**orphology, anatomy, reproduction and life-cycles of *Riccia*, *Anthoceros,* and *Funaria.* Ecological and economic importance of Bryophytes. Fossil Bryophytes. | 5 |
| **Chapter No. 6. . Pteridophytes**- General characteristics and classificationEcological and economic importance. Morphology, anatomy, reproduction and life-cycles in *Selaginella*, *Equisetum*, *Pteris* and *Salvinia*. | 5 |
| **Unit – 3** | 15 |
| **Chapter No. 7** A brief account of heterospory and seed habit. Stelar evolution in Pterodophytes. Affinities and evolutionary significance of Pteridophytes. | 5 |
| **Chapter No. 8. Gymnosperms-** General characteristics. Distribution and classification of Gymnosperms. Study of the habitat, Anatomy, reproduction and life-cycles in *Cycas*, *Pinus* and *Gnetum*. | 5 |
| **Chapter No. 9.** Affinities and evolutionary significance of Gymnosperms. Economic importance of Gymnosperms - food, timber, industrial uses and medicines. | 5 |
| **Unit – 4** | 11 |

| | |
|---|---|
| **Chapter No. 10. Origin and evolution of Plants:** Origin and evolution of plants through Geological Time scale. | 2 |
| **Chapter No. 11. Paleobotany-** Paleobotanical records, plant fossils, Preservation of plant fossils - impressions, compressions, petrification's, moulds and casts, pith casts. Radiocarbon dating. | 5 |
| **Chapter No. 12.** Fossil taxa- *Rhynia, Lepidodendron, Lepidocarpon,Lyginopterisand Cycadeoidea*. Exploration of fossil fuels. Birbal Sahni Institute of Paleosciences. | 4 |

## Text Books


1) Chopra,G.L.AtextbookofAlgae.Rastogi&Co.,Meerut,Co.,NewDelhi,Depot. Allahabad.
2) Johri, Lata anf Tyagi, 2012, A Text Book of, Vedam e Books, NewDelhi.
3) Sharma, O.P. 1990. Text Book of Pteridophyta. McMillan India Ltd. NewDelhi.
4) Sharma, O.P. 1992. Text Book of Thallophytes. McGraw Hill Publishing Co. New Delhi.
5) Sharma, O.P.,2017, AlgaeSingh-Pande-Jain2004-05. A Text Book of Botany. Rastogi Publication, Meerut.


## References


1. Sambamurty, A.V.S.S.. A Text Book of Algae. I.K. International Private Ltd., New Delhi.
2. Agashe, S.N.1995. Paleobotany, Plants of the past, their evolution, paleo environment and Allied plants. Hutchinson & Co., Ltd., London.
3. Anderson R.A. 2005, Algal cultural Techniques, Elsievier, London.
4. Publication, Application in exploration of fossil fuels. Oxford & IBH., New Delhi.

5. Eams, A.J., (1974) Morphology of vascular plants - Lower groups. Tata Mc Grew-Hill Publishing Co. New Delhi, Freeman & Co., New York.
6. Fritze, R.E. 1977. Structure and reproduction of Algae. Cambridge University Press.
7. Goffinet B and Shaw A.J. 2009, Bryophyte Biology, 2nd ed. Cambridge Unversity Press, Cambridge .Gymnosperms.
8. Srivastava, H N, 2003. Algae Pradeep Publication, Jalandhar, India.
9. Kakkar, R.K. and B.R.Kakkar ( 1995) The Gymnosperms (Fossils and Living) Central Publishing House, Allahabad.
10. Kumar H. D., 1999, Introductory Phycology, Affiliated East-West Press, Delhi.
11. Lee, R.E., 2008, Phycology, Cambridge Unversity Press, Cambridge. 4th edition. McGraw Hill Publishing Co., New Delhi.
12. Parihar, N.S. 1970. An Introduction to Embryophyta. Vol. I. Bryophyta. Central Book, Allhabad.
13. Parihar, N.S. (1976) An Introduction to Pteridophytes, Central Book Depot, Allhabad.
14. Parihar,N.S.1977. The Morphology of Pteridophytes. Central Book Depot., Allahabad. Press, Cambridge.
15. Rashid,A.1998. An Introduction to Pteridophyta, II ed., Vikas Publishing House, New Delhi.
16. Smith, G.M. 1971. Cryptogamic Botany. Vol. II. Bryophytes & Pteridophytes. Tata Tata McGraw Hill Publishing, New Delhi.
17. Smith, G.M. 1971. Cryptogamic Botany. Vol. I Algae & Fungi. Tata McGraw Hill Publishing. New Delhi.

18. Sporne, K.R. 1965. The Morphology of Gymnosperms. Hutchinson & Co., Ltd., London.
19. Stewart, W.M. 1983. Paleobotany and the Evolution of Plants, Cambridge University Cambridge.
20. Sundarajan, S. 1997. College Botany Vol. I. S Chand & Co. Ltd., New Delhi.
21. Vanderpoorten, A. and Goffinet, B. 2009, Introduction to Bryophytes, Cambridge Unversity Press, Cambridge.
22. Vashista, B.R. 1978. Bryophytes. S Chand & Co. Ltd., New Delhi.

**Pedagogy:** Lectures, Practicals, Field and laboratory visits, participatory learning, seminars, assignments, MOOCs and specimen preparation and submission.

| **Formative Assessment** | |
|---|---|
| **Assessment Occasion / type** | **Weightage in Marks** |
| I TEST | 10 |
| II TEST | 10 |
| ASSIGNMENT | 10 |
| **Total** | 30 |

**Date** **Course Co-ordinator** **Subject Committee Chairperson**

## Content of Practical Course 2: List of Experiments to be conducted

**Practical-1:** Study of morphology, classification, reproduction and lifecycle of *Nostoc*/*Oscillatoria.*

**Practical-2:** Study of morphology, classification, reproduction and life-cycle of *Oedogonium & Chara,*Sargassum, *Batrachospermum/ Polysiphonia.*

**Practical-3:** Study of morphology, classification, reproduction and life-cycle of *Riccia & Anthoceros.*

**Practical-4:** Study of morphology, classification, anatomy, reproduction and life-cycle of *Selaginella and Equisetum.*

**Practical -5:** Study of morphology, classification, anatomy, reproduction and life-cycle of *Pteris, Azolla..*

**Practical -6:** Study of morphology, classification, anatomy and reproduction in *Cycas*.

**Practical -7:** Study of morphology, classification & anatomy, reproduction in *Pinus*.

**Practical -8:** Study of morphology, classification & anatomy, reproduction in *Gnetum*.

**Practical -9:** Study of important blue green algae causing water blooms in the lakes.

**Practical -10:** Study of different methods of cultivation of ferns in a nursery.

**Practical -11:** Preparation of natural media and cultivation of *Azolla* in artificial ponds.

**Practical -12:** Media preparation and cultivation of *Spirulina*.

**Practical -13:** Study different algal products and fossils impressions and slides.

**Practical-14:** Visit to algal cultivation units/lakes with algal blooms/Fern house/ Nurseries/Geology museum/lab to study plant fossils.

**(Note: Botanical study tour to a floristic rich area for 1-2 days and submission of study report is compulsory)**

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# DEPARTMENT OF STUDIES & RESEARCH IN BOTANY

## B.Sc 2nd Semester (NEP-2020) Practical Examinations

**Course code.BOT- 2.1 ( Course type-DSCC) Diversity of Non- Flowering Plants**

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

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1. Identify, classify and write the salient features observed of specimen **A, B, C & D** 12 Marks
2. Perform minor experiment **'E'**. Show the preparation to the examiners. 05 Marks
3. Identify the specimen and critically comment on F and G 08 Marks
4. Identify and describe the features observed in the slides/specimen **H, I, J, K and L** 10 Marks
5. Viva voce 05 Marks
6. Submission/s
   i. Study Tour Report 05 Marks
   ii. Practical Record 05 Marks

**Total 50 marks**

Note: The total marks obtained by the candidate is converted to 25 marks (50/2=25.if he/she obtained 40/2=20 marks)

## B.Sc. Semester – II

# THEORY EXAMINATION

## GENERAL PATTERN OF THEORY QUESTION PAPER FOR DSCC/ OEC

**Time: 3 hrs** **60 Marks**

**Part-A**

Question number 1-7 carries 2 marks each. Answer any 5 questions : 10marks

**Part-B**

Question number 08- 13 carries 05 Marks each. Answer any 4 questions : 20 marks

**Part-C**

Question number /14-18 carries 10 Marks each. Answer any 03 questions : 30 marks

**Total: 60 Marks**

**Note: 1. Minimum 1 question from each unit and 10 marks question may have sub questions for 7+3 or 6+4 or 5+5 if necessary)**

**Note: 2. Proportionate weight-age shall be given to each unit based on number of hours prescribed.**

**B.Sc. BOTANY: Semester - 3**

**Theory: Discipline Specific Core Course (DSCC)**
**Title of the Course and Code:**
**BOT-A-3.1: PLANT ANATOMY AND DEVELOPMENT BIOLOGY**

| Course No. | Type of Course | Theory / Practical | Credits | Instruction hour per week | Total No. of Lectures/ Hours / Semester | Duration of Exam | Formative Assessment Marks | Summative Assessment Marks | Total Marks |
|---|---|---|---|---|---|---|---|---|---|
| **BOT-A-3.1** | DSCC | Theory | 04 | 04 | 56 hrs | 3hrs | 40 | 60 | 100 |

## Course Outcomes:

On completion of this course, the students will be able to:
1. Observation of variations that exist in internal structure of various parts of a plant and as well as among different plant groups in support for the evolutionary concept.
2. Skill development for the proper description of internal structure using botanical terms, their identification and further classification.
3. Induction of the enthusiasm on internal structure of locally available plants.
4. Understanding various levels of organization in a plant body with an outlook in the relationship between the structure and function through comparative studies.
**5.** Observation and classification of the floral variations from the premises of college and house.
6. Understanding the various reproductive methods sub-stages in the life cycle of plants
7. Observation and classification of the embryological variations in angiosperms.
8. Enthusiasm to understand evolution based on the variations in reproduction among plants.

## PLANT ANATOMY

### Unit 1: ANGIOSPERM ANATOMY, PLANT CELL STRUCTURE AND TISSUES

**14 Hrs**

Introduction, objectiveand scope of Plant Anatomy, Plant cell structure – nature of plant cell wall.
***Tissue and tissue systems*** - meristematic tissue, permanent tissue and secretary cells.
Classification of meristem: (apical, intercalary and lateral), primary and secondary meristem.
***Apical meristem:*** Theories on organization of meristem (apical cell theory, Tunica-Corpus theory, histogen theory and Korper-Kappe theory), quiescent centre, Root cap.
Evolution and concept of organization of shoot apex (Apical cell theory, Histogen theory, Tunica Corpus theory continuing meristematic residue, cytohistological zonation).

### Unit II: MORPHOGENESIS AND DIFFERENTIATION 14 Hrs.

Morphogenesis in plants - Differentiation of root, stems and leaf.
Types of vascular bundles and Vascular cambium, Origin, development, arrangement and diversity in size and shape of leaves.
Structure of Dicot root: primary and secondary structures (Tridax/Sunflower), Structure of monocot root (Maize).

Structure of Dicot stem: Primary and secondary structures (Tridax/Sunflower), Structure of Monocot stem (Maize), Nodal anatomy.

Structure of Dicot leaf: primary structure (Tridax/Sunflower), primary structure of Monocot leaf (Maize),, Stomatal types. Anomalous secondary growth: Aristolochia, Boerhaavia (dicot stem) Dracaena (monocot stem)

Applications in systematics, forensics and Pharmacognosy.

## DEVELOPMENT BIOLOGY

**Unit III: Morphogenesis and Differentiation** **14 Hrs.**

Differentiation and cell polarity in acellular (*Dictyostelium*), Unicellular (*Acetabularia*) and multicellular system (root hair and stomata formation) Shoot Apical meristem (SAM): Origin, structure and function, Cytohistological zonation and Ultrastructure of meristems.Organogenesis: Differentiation of root, stem, leaf and axillary buds, bud dormancy

Mechanism of leaf primordium initiation, development and Phyllotaxis (Diversity in size and shape of leaves)

Structure and function of root apical meristem (RAM): Root cap, quiescent centre and origin of lateral roots.

Transition from vegetative apex into reproductive apex

Developmental patterns at flowering apex: ABC model specification of floral organs. Modification of gene action by growth hormones and cellular differences between floral organs. Senescence – a general account.

**Unit IV: Reproductive Biology** **14 Hrs.**

Introduction, Scope and contributions of Indian embryologists: P. Maheswari, B G L Swamy, P.Maheshwari, M.S. Swaminathan and K.C. Mehta.

**Microsporangium**: Development and structure of mature anther, Anther wall layers, Tapetum -types, structure and functions and sprogenous tissue.

**Microsporogenesis -** Microspore mother cells, microspore tetrads, Pollinia.

**Microgametogenesis** – Formation of vegetative and generative cells, structure of male gametophyte. Pollen embryosac (Nemec phenomenon).

**Megasporangium –** Structure of typical Angiosperm ovule.Types of ovule- Anatropous, Orthotropous, Amphitropous, Circinotropous.**Megagametogenesis –** Types of development of Female gametophyte/embryosac- monosporic- *Polygonum* type, bisporic – *Allium* type, tetrasporic - *Fritillaria* type. Structure of mature embryosac.

**Pollination and fertilization:** Structural and functional aspects of pollen, stigma and style. Post pollination events; Current aspects of fertilization and Significance of double fertilization, Post fertilization changes.

**Endosperm** – Types and its biological importance. Free nuclear (*Cocos nucifera*) cellular (*Cucumis),* helobial types. Ruminate endosperm.

**Embryogenesis –** Structure and composition of zygote ,Dicot (*Capsella bursa-pastoris)*and Monocot (*Najas)* embryo development. A general account of seed development.

**B.Sc. BOTANY: Semester - 3**

**Practical: Discipline Specific Core Course (DSCC)**

**Title of the Course and Code:**

**BOT-A-3.2: PLANT ANATOMY AND DEVELOPMENT BIOLOGY**

| Course No. | Type of Course | Theory / Practical | Credits | Instruction hour per week | Total No. of Lectures/ Hours / Semester | Duration of Exam | Formative Assessment Marks | Summative Assessment Marks | Total Marks |
|---|---|---|---|---|---|---|---|---|---|
| **BOT-A-3.2** | DSCC | Practical | 02 | 04 | 52 hrs | 3hrs | 25 | 25 | 50 |

## LIST OF EXPERIMENT TO BE CONDUCTED

**Practical No.1**

i) Study of meristem (Permanent slides/ Photographs).

ii) Study of Simple Tissues (Parenchyma, Collenchyma and Sclerenchyma)and Complex Tissues (xylem and phloem).

**Practical No.2**

Maceration technique to study elements of xylem and phloem, Study of primary structure of dicot root, stem and leaf (Sunflower) and monocot root, stem and leaf (Maize)

**Practical No.3**

Study of Normal secondary growth structure in dicot stem and root (Sunflower) and Anomalous secondary growth: *Aristolochia, Boerhaavia* (dicot stem) *Dracaena* (monocot stem)

**Practical No. 4**

Study of trichomes (any three types) and stomata (any three types) with the help of locally available plant materials

**Practical No. 5**

Permanent slides of Microsporogenesis and male gametophyte Mounting of Pollen grains of Grass and Hibiscus and Pollinia of Calotropis

**Practical No. 6**

Pollen germination (hanging drop method) and Effect of Boron and Calcium on pollen germination

**Practical No. 7**

Permanent slides of types of ovules, Megasporogenesis & embryosac development and types of placentation: Axile, Marginal and Parietal types. Sectioning of ovary, for the studied types of placentation

**Practical No. 8**

Mounting of embryo: Tridax and Cyamopsis, Mounting of endosperm: Cucumis

**Practical No. 09**

Histo chemical localization of proteins/ carbohydrates

**Practical No. 10 and 11**

Mini project work in groups of 3-5 students, from the following list

a) Study of pollen morphology of different flowers with respect to shape, colour, aperture etc.

b) Pollen germination of different pollen grains and calculates percentage of germination.

c) Calculating percentage of germination of one particular type of pollen grain collected from different localities/ under different conditions.

d) Study of placentation of different flowers.

e) Any other relevant study related to Anatomy / Embryology.

**Text Books for Reference:**


1. Bhojwani and Bhatnagar, Introduction to Embryology of Angiosperms –Oxford & IBH, Delhi
2. Bhojwani Sant Saran, 2014.Current Trends in the Embryology of Angiosperms**,** Woong-Young Soh, Springer Netherlands,
3. Coutler E. G. , 1969. Plant Anatomy – Part I Cells and Tissues – Edward Arnold, London.
4. Dickison, W.C. (2000). Integrative Plant Anatomy, Harcourt Academic Press, USA
5. Eames A. J. - Morphology of Angiosperms - Mc Graw Hill, New York.
6. Esau, K. 1990. Plant Anatomy, Wiley Eastern Pvt Ltd New Delhi
7. Evert, R.F. (2006) Esau's Plant Anatomy: Meristem, Cells, and Tissues of the Plant Body: Their Structure, Function and Development. John Wiley and Sons, Inc
8. Fahn, A.1992. Plant Anatomy, Pergamon Press, USA
9. Johri, B.M. l., 1984.Embryology of Angiosperms, Springer-Verlag, Netherlands.
10. Karp G., 1985. Cell Biology; Mc.Graw Hill Company
11. Maheshwari,P 1950. An introduction to the embryology of angiosperms. New York: McGraw-Hill
12. Mauseth, J.D. (1988). Plant Anatomy, the Benjammin/Cummings Publisher, USA.
13. Nair P .K .K - Pollen Morphology of Angiosperms - Scholar Publishing House, Lucknow
14. Pandey S.N. 1997, Plant Anatomy and Embryology .A. Chadha, Vikas Publication House Pvt Ltd;
15. Pandey, B. P., 1997. Plant Anatomy, S.Chand and Co. New Delhi
16. Raghavan, V., 2000. Developmental Biology of Flowering plants, Springer, Netherlands.
17. Saxena M. R. – Palynology – A treatise - Oxford & I. B .H., New Delhi.
18. Shivanna, K.R., 2003. Pollen Biology and Biotechnology. Oxford and IBH Publishing Co. Pvt.Ltd. Delhi.
19. Vashishta .P.C .,1984. Plant Anatomy – Pradeep Publications – Jalandhar
20. Vashishta, P.C. 1997. Plant Anatomy, Pradeep Publications

N. N. Bhandari The Microsporangium
F. Bouman The Ovule
M. T. M. Willemse, J. L. van Went The Female Gametophyte
R. B. Knox The Pollen Grain
J. L. van Went, M. T. M. WillemsFertilization

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DEPARTMENT OF COLLEGIATE EDUCATION)
**GOVERNMENT COLLEGE, (AUTONOMOUS) KALABURAGI,**
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## DEPARTMENT OF STUDIES & RESEARCH IN BOTANY

**B.Sc III Semester (NEP-2020) Practical Examinations**

**PLANT ANATOMY AND DEVELOPMENT BIOLOGY** Course code.BOT- 1.3.1 ( Course type-DSCC)

Time : 3 Hrs. Max Marks : 25

| | | |
|---|---|---|
| Q.1 | Prepare a temporary double stained T.S of Material "A" identify, sketch and label with reasons (Leave the Preparation for observation and evaluation) | 05 |
| Q.2 | Macerate / Mount the specimen "B" identify any two Xylary elements / Sclerieds Stomatal index / Trichrome with labeled sketches and give reasons. | 03 |
| Q.3 | Mount the Endosperm of Specimen "C", Sketch and label the parts giving reasons (Leave the Preparation for observation and evaluation) | 05 |
| Q.5 | Identify and describe the Slides "E" ,"F" ,"G" & "H" with reasons. | 08 |
| Q.6 | Record Book | 04 |
| | | 25 |

# THEORY EXAMINATION

## GENERAL PATTERN OF III Sem THEORY QUESTION PAPERFOR DSCC/ OEC

Time: 3 hrs

60 Marks

Part-A

Question number 1-7 carries 2 marks each. Answer any 5 questions : 10marks

Part-B

Question number 08- 13 carries 05 Marks each. Answer any 4 questions : 20 marks

Part-C

Question number /14-18 carries 10 Marks each. Answer any 03 questions: 30 marks

Total: 60 Marks

Note: 1. Minimum 1 question from each unit and 10 marks question may havesub questions for 7+3 or 6+4 or 5+5 if necessary)
Note: 2. Proportionate weight-age shall be given to each unit based on numberof hours prescribed.

# B.Sc. B0TANY SEMESTER IV

## Title of The Course: Ecology and Conservation Biology

| Number of Theory Credits | Total Lecture Hours/Semester | Number of Practical Credits | Total Practical hours/Semester |
|---|---|---|---|
| 04 | 56 | 02 | 56 |

| Contents of Theory Course | | |
|---|---|---|
| **Unit 1** | **Topics** | **Teaching Hours** |
| I | **Introduction to Ecology and Conservation Biology:**<br>Definitions, Principles of Ecology, Brief History, Major Indian Contributions, Scope and importance. Ecological levels of organisation.<br>**Ecological factors:** Climatic factors: light, temperature, precipitation and humidity.<br>**Edaphic factors**: Soil and its types, soil texture, soil profile, soil formation; physico-chemical properties of soil - mineral particle, soil pH, soil aeration, organic matter, soil humus and soil microorganisms.<br>Topographic Factors: Altitude<br>**Ecological groups of plants and their adaptations:** Morphological and anatomical adaptations of hydrophytes, xerophytes, epiphytes and halophytes. | 15 hrs |
| II | **Ecosystem Ecology:** Introduction,types of ecosystems with examples -terrestrial and aquatic, natural and artificial.<br>Structure of ecosystem: Biotic and Abiotic components, detailed structure of a pond ecosystem.<br>Ecosystem functions and processes: Food chain-grazing and detritus; Food web. Ecological pyramids -Pyramids of energy, biomass and number. Principles of Energy flow in ecosystem.<br>Bio-geo chemical cycles: Gaseous cycles -carbon and nitrogen, Sedimentary cycle-Phosphorus.<br>Ecological succession: Definition, types- primary and secondary. General stages of succession. Hydrosere and xerosere.<br><br>**Community Ecology:** Community and its characteristics – frequency, density, Abundance, cover and basal area, phenology, stratifications, life-forms. Concept of Ecotone and Ecotypes.<br>Intra-specific and Inter-specific interactions with examples.<br><br>**Ecological methods and techniques:** Methods of sampling plant communities – transects and quadrates. Remote sensing as a tool for vegetation analysis, land use – land cover mapping.<br><br>**Population Ecology:** Population and its characteristics – Population density, natality, mortality, age distribution, population growth curves and dispersal. | 15 hrs |

| | | |
|---|---|---|
| III | **Phytogeography and Environmental issues:**<br><br>Theory of land bridge, theory of continental drift, polar oscillations and glaciations. Centre of origin of plant – Vavilov's concept, types. Phytogeographical regions – concept, phytogeographical regions of India.<br>Vegetation types of Karnataka – Composition and distribution of evergreen, semi-evergreen, deciduous, scrub, mangroves, shoal forests and grasslands. An account of the vegetation of the Western Ghats.<br>Pollution: Water pollution: Causes, effect, types; water quality indicators, water quality standards in India, control of water pollution (Waste water treatment).<br>Water pollution disasters – National mission on clean Ganga ,Minimata, Pacific gyre garbage patch, Exxon valdez oil spill.<br>Air pollution: Causes, effect, air quality standards, acid rain, control.<br>Soil pollution: Causes, effect, solid waste management, control measures of soil pollution. | 11hrs |
| IV | **Biodiversity and its conservation:**<br>Biodiversity: Definition, types of biodiversity - habitat diversity, species diversity and genetic diversity, Global and Indian species diversity. SDG's in biodiversity conservation.<br>Values of Biodiversity – Economic and aesthetic value, Medicinal and timber yielding plants. NTFP. Threats to biodiversity.<br>Concept of Biodiversity Hotspots, Biodiversity hot spots of India.<br>Concept of endemism and endemic species.<br>ICUN plant categories with special reference to Karnataka/ Western Ghats.<br>Biodiversity Conservation- Indian forest conservation act, Biodiversity bill (2002).<br>Conservation methods – *In-situ* and *ex-situ* methods<br>*In-situ* methods –Biosphere reserves, National parks, Sanctuaries, Sacred grooves.<br>*Ex-situ* methods-Botanical gardens, Seed bank, Gene banks, Pollen banks, Culture collections, Cryopreservation. | 15 hrs |
| | **Total** | **56 Hours** |

## SUGGESTED REFERENCE BOOKS:


1. Sharma, P.D. 2018. Fundamentals of Ecology. Rastogi Publications.
2. Odum E.P. (1975): Ecology By Holt, Rinert & Winston.
3. Oosting, H.G. (1978): Plants and Ecosystem Wadworth Belmont.
4. Kochhar, P.L. (1975): Plant Ecology. (9th Edn.,) New Delhi, Bombay, Calcutta-226pp.,
5. Kumar, H.D. (1992): Modern Concepts of Ecology (7th Edn.,) Vikas Publishing Co., New Delhi.
6. Kumar H.D.(2000): Biodiversity & Sustainable Conservation. Oxford & IBH Publishing Co Ltd.New Delhi.
7. Newman, E.I. (2000): Applied Ecology, Blackwell Scientific Publisher, U.K.
8. Chapman, J.L&M.J. Reiss (1992): Ecology (Principles & Applications). Cambridge University Press, U.K.
9. Malcolm L. Hunter Jr., James P. Gibbs, Viorel D. Popescu, 2020. Fundamentals of Conservation Biology, 4th Edition. Wiley-Blackwel.
10. Saha T. K., 2017.Ecology and Environmental Biology. Books and Allied Publishers.

## List of Practicals in Ecology and Conservation Biology

| Practical No. | Experiments |
|---|---|
| 1 | Determination of pH of different types of Soils, Estimation of salinity of soil/water samples. |
| 2 | Study of Ecological instruments – Wet and Dry thermometer, Altimeter, Hygrometer, Soil thermometer, Rain Gauge, Barometer, etc |
| 3 | Hydrophytes: Morphological adaptations in *Pistia, Eichhornia, Hydrilla, Nymphaea.* Anatomical adaptations in *Hydrilla*(stem) and *Nymphaea* (petiole). |
| 4 | Xerophytes: Morphological adaptations in *Asparagus, Casuarina, Acacia, Aloe vera, Euphorbiatirucalli.* Anatomical adaptations in phylloclade of *Casuarina* . |
| 5 | Epiphytes: Morphological adaptations in *Acampe, Bulbophyllum, Drynaria*.Anatomical adaptations in epiphytic root of *Acampe/ Vanda.*<br>Halophytes: study of Vivipary in mangroves, Morphology and anatomy of Pneumatophores. |
| 6 | Study of a pond/forest ecosystem and recording the different biotic and abiotic components |
| 7 | Demonstration of different types of vegetation sampling methods – transects and quadrats. Determination of Density and frequency. |
| 8 | Application of remote sensing to vegetation analysis using satellite imageries |
| 9 | Field visits to study different types of local vegetations/ecosystems and the report to be written in practical record book. |
| 10 | Determination of water holding capacity of soil samples |
| 11 | Determination of Biological oxygen demand (BOD) |
| 12 | Determination of Chemical oxygen demand (COD) |
| 13 | Determination of soil texture of different soil samples. |

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# DEPARTMENT OF STUDIES & RESEARCH IN BOTANY
## B.Sc IV Semester (NEP-2020) Practical Examinations

**Course code.BOT- 1.4.1 ( Course type-DSCC)** **Ecology And Conservation Biology**

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

| | |
|---|---|
| Q1. Determine the BOD / COD of the given water sample A | 10 Marks |
| Q2. Write the Ecological Adaptations of B and C (Morphological and Anatomical ). | 10 marks |
| Q3. Identify and comment on Ecological Instrument D & E | 08 Marks |
| Q4. Identify and comment on photograph / slides/ F & G | 06 Marks |
| Q5. Viva voce | 05Marks |
| 06. Study Tour Report | 0 6 Marks |
| 07. Practical Record | 05Mark |
| | ---------- |
| | **Total 50 mark** |

Note: The total marks obtained by the candidate is converted to 25 marks (50/2=25.if he/she obtained 40/2=20 marks)

# THEORY EXAMINATION

## GENERAL PATTERN OF 4thSem THEORY QUESTION PAPERFOR DSCC/ OEC

Time: 3 hrs

60 Marks

Part-A

Question number 1-7 carries 2 marks each. Answer any 5 questions: 10marks

Part-B

Question number 08- 13 carries 05 Marks each. Answer any 4 questions: 20 marks

Part-C

Question number /14-18 carries 10 Marks each. Answer any 03 questions: 30 marks

Total: 60 Marks

Note: 1. Minimum 1 question from each unit and 10 marks question may havesub questions for 7+3 or 6+4 or 5+5 if necessary)
Note: 2. Proportionate weight-age shall be given to each unit based on numberof hours prescribed.

Syllabus, Scheme of Examination Pattern of Papers for

B.Sc (Botany) V & VI Semester Courses

**BOARD OF STUDIES IN BOTANY**

**DEPARTMENT OF STUDIES & RESEARCH IN BOTANY**

**2023-24**

***Model Curriculum of B.Sc. in BOTANY***

# 5thSemester

# BOTANY Curriculum

## Plant Morphology and Taxonomy (Theory)

| | | | |
|---|---|---|---|
| Program Name | **B.Sc. in BOTANY** | Semester | **V** |
| Course Title | **Plant Morphology and Taxonomy (Theory)** | | |
| Course Code: | **DSC – BOT-C5 – T** | No. of Credits | **04** |
| Contact hours | **60 Hours** | Duration of SEA/Exam | **2 hours** |
| Formative Assessment Marks | **40** | Summative Assessment Marks | **60** |

**Course Pre-requisite(s):**

**Course Outcomes (COs)**: After the successful completion of the course, the student will be able to:

CO1. Understanding the main features in Angiosperm evolution

CO2. Ability to identify, classify and describe a plant in scientific terms, thereby, Identification of plants using dichotomous keys. Skill development in identification and classification of flowering plants.

CO3. Interpret the rules of ICN in botanical nomenclature.

CO4. Classify Plant Systematic and recognize the importance of herbarium and Virtual Herbarium, Evaluate the Important herbaria and botanical gardens.

CO5. Recognition of locally available angiosperm families and plants and economically important plants. Appreciation of human activities in conservation of useful plants from the past to the present.

| **Contents** | **60 Hrs** |
|---|---|
| **Unit 1:** | **15 hrs** |
| **Morphology** of Root, Stem and Leaf. Their modifications for various functions. Inflorescence – types. Structure and variations of flower. Fruits–types. Floral diagram and floral formula.<br>**Introduction to Taxonomy**: History, objectives, scope and relevance of Taxonomy<br>**Systems of classification**: Artificial, Natural and Phylogenetic; brief account of Linnaeus', Bentham& Hooker's, Engler and Prantl's system-Merits anddemerits of classification.<br>**Taxonomic literatures:** Floras, Monograph. Revisions, Journals.<br>**Herbaria and Botanical gardens:** Important herbaria and botanical gardens of the world and India. Technique of Herbarium Preparation and roles botanical gardens.<br>**Virtual herbarium;** E-flora; Documentation. | |
| **Unit 2:** | **15 hrs** |
| **Plant identification**: Taxonomic dichotomous keys; intended (yolked) and bracketed keys. (brief account only).<br>**Plant descriptions**: Common Terminologies used for description of vegetative and reproductive parts of the following families. | |

| | |
|---|---|
| **Study of the diagnostic features of Angiosperm families (Any 15 from the listed):** Annonaceae, Brassicaceae, Malvaceae, , Fabaceae (with sub Families), , Cucurbitaceae, , Rubiaceae, Asteraceae, Apocynaceae, Solanaceae, , Lamiaceae, Amaranthaceae, Euphorbiaceae, Orchidaceae /, Liliaceae / / Poaceae.<br>**Plant Taxonomic Evidences:** from palynology embryology, cytology, phytochemistry and molecular data. Field inventory. | |
| **Unit 3:** | **15 hrs** |
| **Taxonomic Hierarchy**: Concept of taxa (family, genus, species); Categories and taxonomic hierarchy; Species concepts (biological, morphological, evolutionary). Modes of speciation. Problems with species concepts.<br>**Botanical Nomenclature:** Principles and rules (ICN); Latest code –brief account, Brief account of Ranks of taxa, Type concept (Typification), Rule of priority, Author citation., valid publication, rejection of names, principle of priority and its limitations; Names of cultivated species. | |
| **Unit 4:** | **15 hrs** |
| **Biometrics, Numerical Taxonomy; Phenetics and Cladistics:** Characters; Variations; OTUs, character weighting and coding; Cluster analysis; Phenograms, cladograms (definitions and differences).<br>**Phylogenetic Systematics:** Basic concepts (primitive and advanced, homology and analogy, parallelism and convergence, monophyly, Paraphyly, polyphyly, clades, synapomorphy, symplesiomorphy, apomorphy, lineage sorting, serial homology etc).<br>**Origin and evolution of angiosperms;**; Methods of illustrating evolutionary relationship (phylogenetic tree, cladogram).<br>**Molecular taxonomy:** Respect to DNA sequences of chloroplast genes (*atp*B, rbcL, ITS, trnL etc) and one nuclear gene (nuclear ribosomal 18s DNA). | |

**Pedagogy:** Teaching and learning, Seminar, Assignments, etc

| **Formative Assessment for Theory** | |
|---|---|
| **Assessment Occasion/ type** | **Marks** |
| Attendance | 05 |
| Test (Objective type + Descriptive) | 15 (5+10) |
| Assignments | 10 |
| Seminar / Field Visit | 10 |
| **Total** | **40 Marks** |
| ***Formative Assessment as per guidelines are compulsory*** | |

| Program Name | **B.Sc. in BOTANY** | Semester | **V** |
|---|---|---|---|
| Course Title | **Plant Morphology and Taxonomy (Practical)** | Practical Credits | **02** |
| Course Code | **DSC – BOT – C6 – P** | Contact Hours | **4 Hours per week** |
| Formative Assessment | **25 Marks** | Summative Assessment | **25 Marks** |

**Practical Content**

1. Study of root, stem and leaf structure and modifications. Study of inflorescence types. Study of flower and its parts, Study of fruits. Floral diagram and floral formula.

2. Study of families mentioned in theory with at least two examples for each family and make suitable diagrams, describe them in technical terms (Description, V.S. flower, section of ovary, floral diagram/s, floral formula/e and systematic position according to Bentham & Hooker's system of classification) and identify up to species using the flora. **26 hrs**

3. Costruction of Dichotomous plants of selected families, Gunus, Species with various phylogenetic methods (Neibour Joining, Maximum Likelihood etc). **06 hrs**

4. Identify plants/plant products of economic importance belonging to the families mentioned in the syllabus; with binomial, family and morphology of useful parts. Cotton, Mango, Red gram, Green gram, Horse gram, Black gram, Bengal gram, Indigo, Brinjal, Tomato, Chilly, Tamarind, Bitter gourd, *Luffa*, Asfoetida, Cumin, Coriander, Coffee, Rubber, Tapioca, Ricinus, Ginger, Turmeric, Coir, Arecanut, Rice, Wheat, Ragi, Sugarcane *Annona muricata Catharanthus roses*, *Rauvolfia serpentaina*, *Justicia adhatoda*, *Vitex nigundo* and *Leucas aspera* **16 hrs**

5. **Field visit**: Local or Crop Field / Botanical garden/ tribal settlements minimum 3 to 5 days.

6. **Submission:** Record book, Tour report and Herbarium (Preparation of 10 properly identified herbarium specimens; mounting of a properly dried and pressed specimen of any common plants fromyour locality with herbarium label).

**Pedagogy:** Teaching and learning, conducting experiments, field visits.

| **Formative Assessment for Practical** | |
|---|---|
| **Assessment Occasion/ type** | **Marks** |
| Attendance | 05 |
| Test | 05 |
| Field visit (3 to 5 days)- Report of Field Visit | 05 |
| Submission (Record book, Tour report and Herbarium) | 10 (2+3+5) |
| **Total** | **25 Marks** |
| ***Formative Assessment as per guidelines are compulsory*** | |

# GENERAL PATTERN OF THEORY QUESTION PAPER

*(60 marks for semester end Examination with 2 hrs duration)*

**Part-A**

1. Question number 1-06 carries 2 marks each. Answer any 05 questions: 10 marks

**Part-B**

2. Question number 07- 11 carries 05 Marks each. Answer any 04 questions: 20 marks

**Part-C**

3. Question number 12-15 carries 10 Marks each. Answer any 03 questions : 30 marks

(Minimum 1 question from each unit and 10 marks question may have sub-questions for 7+3 or 6+4 or 5+5 if necessary)

**Total: 60 Marks**

**Note: Proportionate weightage shall be given to each unit based on number of hours prescribed.**

# SCHEME OF PRACTICAL EXAMINATION

*(distribution of marks): 25 marks for the Semester end examination*

| | |
|---|---|
| 1. Identify, classify and describe the specimen A & B taxonomically | 6 Marks |
| 2. Identify the given specimen C with the help of Key using Flora | 4 Marks |
| 3. Write the floral diagram and floral formal of the given specimen D | 2 Marks |
| 4. Identification of Specimen/slides E, F and G | 6 Marks |
| 5. Viva Voce | 2 Marks |
| 6. Submission (Journal / Record +Study Tour Report) | 5 Marks |

*Total 25 marks*

**General instructions:**

Q1. Give specimen from Dicotyledons (A) and Monocotyledons (B)
Q2. Give specimen from family they studied (C)
Q3. Give specimen from family they studied (D)
Q4. Specimen /Slides/ materials from Root/Stem/ Leaf/ Inflorescence (E), Flower/Fruit (F) and Economic importance (G)
Q5. Viva
Q6. Submission (Journal/ Record + Study Tour Report)

**Note: Same Scheme may be used for IA (Formative Assessment) examination**

| **References** | |
|---|---|
| 1 | Baker. H.G. 1970. Plant and Civilization, Wadsworth Publishing Company. |
| 2 | Colton C.M. 1997. Ethnobotany – Principles and applications. John Wiley and sons –Chichester |
| 3 | Cotton, C.M. 1996. Ethnobotany – Principles and Applications. Wiley and Sons |
| 4 | Datta S C, *Systematic Botany*, 4th Ed, Wiley Estern Ltd., New Delhi, 1988. |
| 5 | Eames A. J. - *Morphology of Angiosperms* - Mc Graw Hill, New York. |
| 6 | Hall, B.G. (2011). *Phylogenetic Trees Made Easy: A How-To Manual*. Sinauer Associates, Inc. USA |
| 7 | Heywood - *Plant taxonomy* - Edward Arnold London. |
| 8 | Jeffrey C .J. and A. Churchil - *An introduction to taxonomy* – London. |
| 9 | Jeffrey, C. (1982). An Introduction to *Plant Taxonomy.* Cambridge University Press, Cambridge |
| 10 | Judd, W.S., Campbell, C.S., Kellogg, E.A., Stevens, P.F., Donogue, M.J., 2002. *Plant Systematics: A Phylogenetic approach,* 2nd edition. Sinauer Associates, Inc., USA. |
| 11 | Lawrence - *Taxonomy of Vascular Plants* - Oxford & I B H, New Delhi. |
| 12 | Manilal, K.S. and M.S. Muktesh Kumar 1998. *A Handbook on Taxonomy Training*. DST, New Delhi. |
| 13 | Manilal, K.S. and A.K. Pandey, 1996. *Taxonomy and Plant Conservation*. C.B.S. Publishers & Distributors, New Delhi. |
| 14 | Manilal, K.S. 2003. *Van Rheede'sHortusMalabaricus. English Edition*, with Annotations andModern Botanical Nomenclature. (12 Vols.) University of Kerala, Trivandrum. |
| 15 | Naik V.N., *Taxonomy of Angiosperms*, 1991. Tata Mcgraw-Hill Pub. Co. Ltd., New Delhi. |
| 16 | Pandey, S. N, and S.P. Misra (2008)-*Taxonomy of Angiosperms*- Ane Books India, New Delhi. |
| 17 | Radford A B, W C Dickison, J M Massey & C R Bell, *Vascular Plant Systematics*, 1974,Harper & Row Publishers, New York. |
| 18 | Singh G.2012. *Plant systematics: Theory and Practice*. Oxford and IBH, Pvt. Ltd., New Delhi. |
| 19 | Singh V. & Jain - *Taxonomy of Angiosperms* - Rastogi Publications, Meerut. |
| 20 | Sivarajan V. V - *Introduction to Principles of taxonomy* - Oxford &I B H New Delhi. |
| 21 | Any local/state/regional flora published by BSI or any other agency. |

# Genetics and Plant Breeding (Theory)

| | | | |
|---|---|---|---|
| Program Name | **B.Sc. in BOTANY** | Semester | **V** |
| Course Title | **Genetics and Plant Breeding (Theory)** | | |
| Course Code: | **DSC – BOT-C7 – T** | No. of Credits | **03** |
| Contact hours | **45 Hours** | Duration of SEA/Exam | **2hours** |
| Formative Assessment Marks | **40** | Summative Assessment Marks | **60** |

**Course Pre-requisite (s):**

**Course Outcomes (COs)**: After the successful completion of the course, the student will be able to:.

CO1.Understanding the basics of genetics and plant breeding

CO2.Abilitytoidentify, calculate and describe crossing over, allelic generations and frequencies of recombination.

CO3.Interprettheresults of mating and pollinations.

CO4.ClassifyPlantpollination methods

CO5.Recognitiono f modes of inheritance of traits/ phenotypes and Phenotype-genotype correlation.

| **Contents** | **45 Hrs** |
|---|---|
| **Unit 1:** | **12hrs** |
| Mendelian genetics and its extension Mendelism: History; Principles of inheritance; Chromosome theory of inheritance; Autosomes and sex chromosomes; Probability and pedigree analysis; Incomplete dominance and codominance; Multiple alleles, Lethal alleles, Epistasis, Pleiotropy, Recessive andDominant traits, Penetrance and Expressivity, Numericals; Polygenic inheritance. Extrachromosomal Inheritance Chloroplast mutation: Variegation in Four o'clock plant; Mitochondrial mutations in yeast. | |
| **Unit 2:** | **12hrs** |
| Linkage, crossing over and chromosome mapping. Linkage and crossing over-Cytological basis of crossing over; Recombination frequency, two factor and three factor crosses; Interference and coincidence; Numerical based on gene mapping; Sex Linkage. Variation in chromosome number and structure: Gene mutations Types of mutations; Molecular basis of Mutations; Mutagens – physical and chemical (Base analogs, deaminating, alkylating and intercalating agents); Detection of mutations: ClBmethod. DNA repair mechanisms. Only two base excision repair (BER) and Nucleotide excision repair (NER). Fine structure of gene (Population and Evolutionary Genetics, Allele frequencies, Genotype frequencies, Hardy-Weinberg Law, role of natural selection, mutation, genetic drift.With reference to maize. | |
| **Unit 3:** | **21 hrs** |
| Plant Breeding: Introduction and objectives. Breeding systems: modes of reproduction in crop plants. Important achievements and undesirable consequences of plant breeding. Methods of crop improvement Introduction: Centers of origin and domestication of crop plants, plant genetic resources; Acclimatization; Selection methods: For self-pollination, cross pollination and vegetative Propagation in plants; Hybridization: For self, cross and vegetative propagation in plants – Procedure, advantages and limitations. | |
| | |

| | |
|---|---|
| Quantitative inheritance :<br>Concept, mechanism, examples of inheritance of Kernel colour in wheat, Monogenic vs polygenic Inheritance.<br>Inbreeding depression and heterosis History, genetic basis of inbreeding depression and heterosis; Applications.<br>Crop improvement and breeding Role of mutations; Polyploidy; Distant hybridization and role of biotechnology in crop improvement. | |

**Pedagogy:** Teaching and learning, Seminar, Assignments, etc

| **Formative Assessment for Theory** | |
|---|---|
| **Assessment Occasion/type** | **Marks** |
| Attendance | 05 |
| Test (Objective type) 5 marks / Descriptive (10 marks) | 15 |
| Assignments | 10 |
| Seminar | 10 |
| **Total** | **40 Marks** |
| ***Formative Assessment as per guidelines are compulsory*** | |

| Program Name | **B.Sc. in BOTANY** | Semester | **V** |
|---|---|---|---|
| Course Title | **Genetics and Plant Breeding (Practical)** | Practical Credits | **02** |
| Course Code | **DSC – BOT – C8 - P** | Contact Hours | **4 Hours per week** |
| Formative Assessment | **25 Marks** | Summative Assessment | **25 Marks** |

**Practical Content**

**Practical: Plant breeding:**

1. Reproductive of biology, self and cross pollinated plants; Vegetative reproduction
2. Hybridization: Emasculation, bagging, pollination and production of hybrids and pollen fertility
3. Origin, distribution and centres of diversity of crop plants: Wheat, Sorghum, Rice, Chilly Sugarcane, Cotton, Potato, coffee, Sunflower and groundnut

**Practical: Genetics**

1. Mendel's laws through seed ratios. Laboratory exercises in probability and chi-square.
2. Chromosome mapping using point test cross data.

Pedigree analysis for dominant and recessive autosomal and sex-linked traits.

3. Incomplete dominance and gene interaction through seed ratios (9:7, 9:6:1, 13:3, 15:1, 12:3:1, 9:3:4).
4. Study of aneuploidy: .in Maize
5. Photographs/Permanent Slides showing Translocation Ring, Laggards and Inversion Bridge.

**Pedagogy:** Teaching and learning, conducting experiments, field / Lab.visits

| **Formative Assessment for Practical** | |
|---|---|
| **Assessment Occasion/type** | **Marks** |
| Attendance | 05 |
| Test | 10 |
| Field visit : Near by Field / Plant breeding centers visit | 05 |
| Submission :charts, Models, Local crop plants, seed collection | 05 |
| **Total** | **25Marks** |
| ***Formative Assessment as per guidelines are compulsory*** | |

# GENERAL PATTERN OF THEORY QUESTION PAPER

*(60 marks for semester end Examination with 2 hrs duration)*

**Part-A**

1. Question number 1-06 carries 2 marks each. Answer any 05 questions: 10 marks

**Part-B**

2. Question number 07- 11 carries 05 Marks each. Answer any 04 questions: 20 marks

**Part-C**

**3.** Question number 12-15 carries 10 Marks each. Answer any 03 questions : 30 marks

(Minimum 1 question from each unit and 10 marks question may have sub-questions for 7+3 or 6+4 or 5+5 if necessary)

**Total: 60 Marks**

**Note: Proportionate weightage shall be given to each unit based on number of hours prescribed.**

# SCHEME OF PRACTICAL EXAMINATION

*(distribution of marks): 25 marks for the Semester end examination*

1. Perform the emasculation / pollen viability / fertility of the given sample **A** 5 Marks
**2.** Calculate the recombinant frequency and state the order of gene from the given data **B** 4 Marks
4. Identification of Specimen/slides/ Photographs **C, D** and **E** 6 Marks
5. Viva Voce 5 Marks
6. Submission (Journal / Record) 5 Marks

*Total 25 marks*

**General instructions:**

Q1 Material Cassia// Hibiscus/ etc (A)
Q2. Mapping using one point / two point test cross data (B)

Q3. Down's, Klinefelter's and Turner's syndromes, Translocation Ring, Laggards and Inversion Bridge (C, D and E)

Q5. Viva
Q6. Submission (Journal/ Record)

**Note: Same Scheme may be used for IA (Formative Assessment) examination**

| References | |
|---|---|
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| 2 | Singh, B.D. (2005). Plant Breeding: Principles and Methods, 7th edition. New Delhi, Delhi: Kalyani Publishers. |
| 3 | Chaudhari, H.K. (1984). Elementary Principles of Plant Breeding, 2nd edition. New Delhi, Delhi: Oxford – IBH. |
| 4 | Gardner, E.J., Simmons, M.J., Snustad, D.P. (1991). Principles of Genetics, 8th edition. New Delhi, Delhi: John Wiley & sons |
| 5 | Griffiths, A.J.F., Wessler, S.R., Carroll, S.B., Doebley, J. (2010). Introduction to Genetic Analysis, 10th |
| | edition. New York, NY: W.H. Freeman and Co. |
| 6 | Klug, W.S., Cummings, M.R., Spencer, C.A. (2012). Concepts of Genetics, 10th edition. San Francisco, California: Benjamin Cummings |
| 7 | Raven, F.H., Evert, R. F., Eichhorn, S.E. (1992).Biology of Plants. New York, NY: W.H. Freeman and Co. |
| 8 | Welsh, J. R. (1981). Fundamentals of Plant Genetics and Breeding. John Wiley and Sons, New York. |
| 9 | Poehlman, J.M. (1987). Breeding Field Crops, 3rd Ed. AVI Publishing Co. Inc., Westport, Connecticut |
| 10 | Chopra, V.L. (2000). Plant Breeding: Theory and Practice 2nd Ed. Oxford & IBH, New Delhi. |


## Program Structure & Proposed Scheme of Teaching & Evaluation for B.SC. (Basic/Hons)

| | Semester –V | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Sl. No.** | **Course Code** | **Title of the Course** | **Category of Courses** | **Teaching Hours per Week (L + T + P)** | **Eaxm Duration** | **SEE** | **IA** | **TotalMarks** | **Credits** |
| 1 | BSC 5.1 | Theory | DSC-1 | 4+0+0 | 2hrs | 60 | 40 | 100 | 4 |
| 2 | BSC5.2 | Practical | DSC-1 | 0+0+2 | 2 hrs | 25 | 25 | 50 | 2 |
| 3 | BSC5.3 | Theory | DSC-2 | 4+0+0 | 2 hrs | 60 | 40 | 100 | 4 |
| 4 | BSC 5.4 | Practical | DSC-2 | 0+0+2 | 2 hrs | 25 | 25 | 50 | 2 |
| 5 | BSC 5.5 | Theory | DSC-3 | 4+0+0 | 2 hrs | 60 | 40 | 100 | 4 |
| 6 | BSC 5.6 | Practical | DSC-3 | 0+0+2 | 2 hrs | 25 | 25 | 50 | 2 |
| 7 | BSC 5.7 | Theory | DSC-4 | 4+0+0 | 2 hrs | 60 | 40 | 100 | 4 |
| 8 | BSC-5.8 | Practical | DSC-4 | 0+0+2 | 2 hrs | 25 | 25 | 50 | 2 |
| 9 | BSC5.9 | Internship | SEC-SB | 0+0+2 | --- | - | 50 | 50 | 2 |
| **Total for V Semester** | | | | | | 340 | 310 | 650 | 27 |

## Paper/ Courses for B.Sc V semester BOTANY

| Sem. No. | Course Category | Course Code | | Credits Assigned | Instructional hours per week | | Duration of Exam (Hrs.) | Exam/ Evaluation Pattern (Marks) | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Theory | Practical | | IA | Exam | Total |
| V | DSC | BOT C5 -T | Plant Morphology and Taxonomy | 4 | 4 | | 2 | 40 | 60 | 100 |
| | | BOT C6 -P | Plant Morphology and Taxonomy | 2 | | 4 | 3 | 25 | 25 | 50 |
| | | BOT C7 -T | Genetics and Plant Breeding | 4 | 4 | | 2 | 40 | 60 | 100 |
| | | BOT C8 -P | Genetics and Plant Breeding | 2 | | 4 | 3 | 25 | 25 | 50 |
| | | | **Internship** | 2 | | | | 25 | 25 | 50 |
| | | | **Total Credits** | **14** | | | | | | |

# Model Curriculum of B.Sc. in BOTANY

# 6th Semester

**BOTANY Curriculum**

# Cell Biology (Theory)

| | | | |
|---|---|---|---|
| Program Name | **B.Sc. in BOTANY** | Semester | **VI** |
| Course Title | **Cell Biology (Theory)** | | |
| Course Code: | **DSC-BOT – C9-T** | No. of Credits | **03** |
| Contact hours | **45 Hours** | Duration of SEA/Exam | **2hours** |
| Formative Assessment Marks | **40** | Summative Assessment Marks | **60** |

**Course Pre-requisite (s):**

**Course Outcomes (COs)**: After the successful completion of the course, the student will be able to:.

CO1. Understanding of Cell metabolism, chemical composition, physiochemical and functional organization of organelle

CO2. Contemporary approaches in modern cell and molecular biology.

CO3.To study the organization of cell, cell organelles and biomolecules (i.e protein, carbohydrate, lipid and nucleic acid)

CO4.To gain knowledge on the activities in which the diverse macro molecules and microscopic structures inhabiting the cellular world of life are engaged.

CO5.To understand the various metabolic processes such as respiration, photosynthesis etc. which are important for life.

| **Contents** | **45Hrs** |
|---|---|
| **Unit 1:** | **15hrs** |
| Cell wall, distribution, chemical composition, functions and variations in prokaryotic and eukaryotic cells (primary and secondary wall), Glycocalyx, Cell-cell interactions/ Junctions, pit connections.<br>Phases of eukaryotic cell cycle, mitosis and meiosis; Regulation of cell cycle- checkpoints, role of protein kinases.<br>Programmed Cell Death; Biology and elementary knowledge of development and causes of cancer. | |
| **Unit 2:** | **15hrs** |
| Structure and functions, active and passive transport, proton pumps associated (Na-K, Cacalmodulin etc. and their distribution), phagocytosis, pinocytosis, exocytosis.<br>Mitochondria & chloroplast Structural organization, function, marker enzymes of the said organelles, biogenesis of mitochondria and chloroplasts, brief account of transport in mitochondria and chloroplasts (Tim/Tom; Tic/Toc) andsemiautonomous nature of mitochondria and chloroplast | |
| **Unit 3:** | **15hrs** |
| Nuclear envelope, structure of nuclear pore complex, nuclear lamina, transport across nuclear membrane, Nucleolus, rRNA processing.<br>Endoplasmic Reticulum – Structure, targeting and insertion of proteins in the ER, protein folding, processing; Smooth ER and lipid synthesis, export of proteins and lipids; Golgi Apparatus – organization, protein glycosylation, protein sorting and export from Golgi Apparatus; Lysosomes | |

**Pedagogy:** Teaching and learning, Seminar, Assignments, etc

| Formative Assessment for Theory | |
|---|---|
| **Assessment Occasion/type** | **Marks** |
| Attendance | 05 |
| Test (Objective type) 5 marks + Descriptive 10 marks | 15 |
| Assignments | 10 |
| Seminar | 10 |
| **Total** | **40 Marks** |
| ***Formative Assessment as per guidelines are compulsory*** | |

| Course Title | **Cell Biology (Practical)** | Practical Credits | **02** |
|---|---|---|---|
| Course Code | **DSC-BOT - C10 –P** | Contact Hours | **4 Hours per week** |
| Formative Assessment | **25Marks** | Summative Assessment | **25 Marks** |
| **Practical Content** | | | |
| 1. Study of plant cell structure with the help of epidermal peel mount of Onion/ Rhoeo/ Crinum.<br>2. Study of cell and its organelles with the help of electron micrographs. As per theory.<br>3. Measurement of length and breadth of plant cell using micrometry.<br>4. Study different stages of mitosis and meiosis (Onion)<br>5. Study of Karyotype using camera-lucida / chart.<br>6. Isolation of cell organelle – Chloroplast – Demonstration | | | |

# GENERAL PATTERN OF THEORY QUESTION PAPER

*(60 marks for semester end Examination with 2 hrs duration)*

**Part-A**

1. Question number 1-06 carries 2 marks each. Answer any 05 questions: 10 marks

**Part-B**

2. Question number 07- 11 carries 05 Marks each. Answer any 04 questions: 20 marks

**Part-C**

**3.** Question number 12-15 carries 10 Marks each. Answer any 03 questions : 30 marks

(Minimum 1 question from each unit and 10 marks question may have sub-questions for 7+3 or 6+4 or 5+5 if necessary)

**Total: 60 Marks**

**Note: Proportionate weightage shall be given to each unit based on number of hours prescribed.**

# SCHEME OF PRACTICAL EXAMINATION

*(distribution of marks): 25 marks for the Semester end examination*

**CELL BIOLOGY**

Time =02 hrs Marks =25

1. Preparation of squash/ smear of material A, identify, Sketch and label the any two stages with reasons 06 marks
2. Find out cell length and breadth of the given material using micrometry 05marks
3. Identify and comment on the slides C & D 04 marks
4. Viva-voce 05 marks
5. Submission (Journal/ Record + 5 slides) 05 marks

*Total 25 marks*

**General instructions:**

Q1. Give specimen from Onion/ Rhoeo/ Crinum plant (A)

Q2. Give specimen from Onion/ Rhoeo leaf (B)

Q3. Give slide from mitosis (C) meiosis (D)

Q4. Viva-voce

Q5. Submission (Journal/ Record + 5 slides)

**Note: Same Scheme may be used for IA (Formative Assessment) examination**


| **References** | |
|---|---|
| 1 | Cooper, G.M., Hausman, R.E. (2009). The Cell: A Molecular Approach, 5th edition. Washington, D.C.: ASM Press & Sunderland, Sinauer Associates, MA |
| 2 | Karp, G. (2010). Cell Biology, 6th edition. New Jersey, U.S.A.: John Wiley & Sons. |
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| 4 | Becker W. M., Kleinsmith L.J. and Bertni G. P. 2009. The World of the Cell. 7th edition. Pearson Benjamin Cummings Publishing, San fransisco. |
| 5 | Reven, F.H., Evert, R.F., Eichhorn, S.E. (1992). Biology of Plants. New York, NY: W.H.Freeman and Company |
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| 7 | Raven, F.H., Evert, R. F., Eichhorn, S.E. (1992).Biology of Plants. New York, NY: W.H. Freeman and Co. |
| 8 | Verma, P. S. (2004). Cell Biology,Genetics, Molecular Biology: Evoloution and Ecology. India: S. Chand Limited. |

# PLANT PHYSIOLOGY AND PLANT BIOCHEMISTRY (THEORY)

| Program Name | **BSc/ BOTANY** | Semester | **VI** |
|---|---|---|---|
| Course Title | **Plant Physiology and Plant Biochemistry (Theory)** | | |
| Course Code: | **BOT C11-T** | No. of Credits | **04** |
| Contact hours | **60 Hours** | Duration of Exam | **2 hours** |
| Formative Assessment Marks | **40** | Summative Assessment Marks | **60** |

**Course Pre-requisite (s):**

**Course Outcomes (COs)**: After the successful completion of the course, the student will be able to:

CO1.Importance of water and the mechanism of transport.
CO2. To understand biosynthesis and breakdown of biomolecules.
CO3. Role of plant hormones in plant development and about secondary metabolites.
CO4. Preliminary understanding of the basic functions and metabolism in a plant body.
CO5. To understand the importance of nutrients in plant metabolism and crop yield.

| **Contents** | **60 Hrs** |
|---|---|
| **UNIT 1** | **15 Hrs** |
| **Plant water relations**: Importance of Water as a solvent, Diffusion, osmosis, imbibition, osmotic pressure, osmotic potential, turgor pressure, wall pressure, water potential and its components. Mechanism of water absorption, Factors affecting water absorption.<br>**Transpiration.** Types and process. Mechanism of guard cell movement. K+ ion mechanism. Antitranspirants.<br>**Mechanism of ascent of sap:** Vital and physical force theories.<br>**Phloem Transport:** Transport of organic solutes. path of transport, vein loading and unloading. Transcellular hypothesis, mass flow hypothesis.<br>**Mineral nutrition :**A brief account on Micro and macro nutrients **.** | |
| **UNIT 2** | **15 Hrs** |
| **Photosynthesis**:<br>Photosynthetic Pigments (Chl a, b, xanthophylls, carotene); Photosystem I and II, reaction center, antenna molecules; Electron transport and mechanism of ATP synthesis; C3, C4 and CAM pathways of carbon fixation; Photorespiration.<br>**Respiration**: Glycolysis, anaerobic respiration, TCA cycle; Oxidative phosphorylation, Glyoxylate, Oxidative Pentose Phosphate Pathway.<br>**Nitrogen metabolism:** Biological nitrogen fixation; Nitrate and ammonia assimilation. | |
| **UNIT 3** | **15 Hrs** |
| Definition and classification of plant growth regulators- Hormones. Site of synthesis, biosynthesis pathway and metabolism and influence on plant growth development of individual group of hormone- Auxins, Gibberlins, cytokinins, ABA, ethylene .<br>Synthetic growth regulators- classification, their effect on plant growth and development. practical utility in agriculture and horticulture**.**<br>**Sensory Photobiology**:<br>Biological clocks, photo periodism, function & structure of phyto chromes, phototropin & cryptochromes.<br>Senescence, Aging & Cell Death (PCD and Autophagosis).<br>Plant Movements | |

| UNIT 4 | 15 Hrs |
|---|---|
| **Carbohydrate metabolism**<br>**Enzymes** - classification, kinetics and mechanism of action.<br>**Proteins and amino acids**: classification, structure - primary, secondary, alpha and beta. | |
| **Vitamins** - classification, distribution, structure, production, function.<br>**Lipids:** classification, structure, function and biosynthesis of fatty acids.<br>**Secondary plant Metabolites**: structure, biosynthesis and distribution of terpenes, phenolicsand nitrogen containing compounds. Alkaloids | |

| Assessment | Marks |
|---|---|
| Attendance | 05 Marks |
| Test(Objective 5 +Descriptive 10 marks) | 15 Marks |
| Seminar | 10 Marks |
| Assignment | 10 Marks |
| **Total** | 40 Marks |
| ***Formative Assessment as per guidelines are compulsory*** | |

## Pedagogy:

| Course Title | **Plant Physiology and Biochemistry (Practical)** | Practical Credits | **2** |
|---|---|---|---|
| Course Code | **BOT C12-P** | Contact Hours | **4 Hours** |
| Formative Assessment | **25 Marks** | Summative Assessment | **25 Marks** |

Practical Content

1. Experiment to demonstrate the phenomenon of exosmosis and endosmosis.
2. To determine the osmotic pressure of the cell sap by plasmolytic method.
3. To demonstrate root pressure / transpiration pull in plants.
4. To compare the rate of transpiration from the two surfaces of leaf by cobalt chloride paper method.
5. To demonstrate that oxygen is liberated in the process of photosynthesis.
6. Separation of photosynthetic pigments by paper chromatography and measure their Rf values.
7 Estimation of total chlorophyll content by Arnon method.
7. To isolate and identify the amino acids from a mixture using paper chromatography.
8. To Study of Phototrophism.
9. Preliminary test for Starch, Protein, Reducing Sugars and Lipids.
10. Estimation of Phenols by A.C.R methods.

# GENERAL PATTERN OF THEORY QUESTION PAPER

*(60 marks for semester end Examination with 2 hrs duration)*

**Part-A**

1. Question number 1-06 carries 2 marks each. Answer any 05 questions: 10 marks

**Part-B**

2. Question number 07- 11 carries 05 Marks each. Answer any 04 questions: 20 marks

**Part-C**

3. Question number 12-15 carries 10 Marks each. Answer any 03 questions : 30 marks

(Minimum 1 question from each unit and 10 marks question may have sub-questions for 7+3 or 6+4 or 5+5 if necessary)

**Total: 60 Marks**

**Note: Proportionate weightage shall be given to each unit based on number of hours prescribed.**

# SCHEME OF PRACTICAL EXAMINATION

**PLANT PHYSIOLOGY AND PLANT BIOCHEMISTRY**

**Time =03 hrs** **Marks =25**

1. Conduct Major Experiment A 06 marks
2. Comment on minor Experiments B & C 06 marks
3. Micro Chemical test D 03 marks
4. Viva-voce 05 marks
5. Practical Record + Industrial visit report 05 marks

**Pedagogy:** Teaching and learning, Seminar, Assignments, etc

| **Formative Assessment for Practical** | |
|---|---|
| **Assessment** | **Marks** |
| Attendance | 10 Marks |
| Test | 10 Marks |
| Project report / Industrial visit | 05 Marks |
| **Total** | **25 Marks** |
| ***Formative Assessment as per guidelines are compulsory*** | |

**REFERENCES**

1. Fundamentals of Biochemistry 2nd Ed, John Wiley and Sons Inc. Wilson, K. and Walker, J. 19942

.JainV K, 2008. Fundamentals of Plant Physiology.S Chand andCo.

3. Kochhar P L, Krishnamoorthy H N. Plant Physiology. Atmaram and sons, Delhi.

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5. Malik CP, 2002. Plant Physiology. Kalyani publishers.

6. Mukherjii S, Ghosh AK, 2005. Plant Physiology. New Central Book Agency, Culcutta.

7. Noggle GR, Fritz GJ, Introductory Plant Physiology.Prentice Hall of India.

8. Pandey SN, Sinha BK, 2006. Plant physiology.Vikas Publishing House, NewDelhi.

9. Salisbury F B, Ross C W, 1992. Plant Physiology. CBS publishers and Distributers, NewDelhi.

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11. Srivastava H S, 2004. Plant physiology and Biochemistry. Rasthogi publications.

12. Verma V, 2007.Text Book of Plant Physiology. Ane Books Pvt. Ltd.

**Program Structure & Proposed Scheme of Teaching & Evaluation for B.SC. (Basic/Hons)**

| Semester –VI | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Sl No** | **Course Code** | **Title of the Course** | **Category of Courses** | **Teaching Hoursper Week (L + T + P)** | **Exam Duration** | **SEE** | **IA** | **Total Marks** | **Credits** |
| 1 | BSC 6.1 | Theory | DSC-1 | 4+0+0 | 2hrs | 60 | 40 | 100 | 4 |
| 2 | BSC6.2 | Practical | DSC-1 | 0+0+2 | 2 hrs | 25 | 25 | 50 | 2 |
| 3 | BSC6.3 | Theory | DSC-2 | 4+0+0 | 2 hrs | 60 | 40 | 100 | 4 |
| 4 | BSC 6.4 | Practical | DSC-2 | 0+0+2 | 2 hrs | 25 | 25 | 50 | 2 |
| 5 | BSC 6.5 | Theory | DSC-3 | 4+0+0 | 2 hrs | 60 | 40 | 100 | 4 |
| 6 | BSC 6.6 | Practical | DSC-3 | 0+0+2 | 2 hrs | 25 | 25 | 50 | 2 |
| 7 | BSC 6.7 | Theory | DSC-4 | 4+0+0 | 2 hrs | 60 | 40 | 100 | 4 |
| 8 | BSC-6.8 | Practical | DSC-4 | 0+0+2 | 2 hrs | 25 | 25 | 50 | 2 |
| 9 | BSC 6.9 | Employability Skills /Cyber Security | SEC-SB | 3+0+0 | 3 hrs | 60 | 40 | 100 | 3 |
| **Total for VI Semester** | | | | | | 400 | 300 | 700 | 27 |

## Paper/ Courses for B.Sc V semester and VI semester in BOTANY

| **Sem. No.** | **Course Category** | **Course Code** | | **Credits Assigned** | **Instructional hours per week** | | **Duration of Exam (Hrs.)** | **Exam/ Evaluation Pattern (Marks)** | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Theory | Practical | | IA | Exam | Total |
| **V** | DSC | BOT C5 –T | Plant Morphology and Taxonomy | 4 | 4 | | 2 | 40 | 60 | 100 |
| | | BOT C6 –P | Plant Morphology and Taxonomy | 2 | | 4 | 2 | 25 | 25 | 50 |
| | | BOT C7-T | Genetics and Plant Breeding | 4 | 4 | | 2 | 40 | 60 | 100 |
| | | BOT C8-P | Genetics and Plant Breeding | 2 | | 4 | 2 | 25 | 25 | 50 |
| | | | **Internship** | 2 | | | | 25 | 25 | 50 |
| | | | **Total Credits** | **14** | | | | | | |
| **VI** | DSC | BOT C9-T | Cell Biology | 4 | 4 | | 2 | 40 | 60 | 100 |
| | | BOT C10-P | Cell Biology | 2 | | 4 | 3 | 25 | 25 | 50 |
| | | BOT C11-T | Plant Physiology and Biochemistry | 4 | 4 | | 2 | 40 | 60 | 100 |
| | | BOT C12-P | Plant Physiology and Biochemistry | 2 | | 4 | 3 | 25 | 25 | 50 |
| | | | | | | | | 40 | 60 | 100 |
| **Total Credit** | | | | **12** | | | | | | |

## B.Sc. BOTANY (5th / 6th Semester ) – Internship Course

Each student who has opted Botany for his compulsory Internship Course, shall work under the supervision of a staff member. The topic of internship shall be of theoretical or Experimental or computational in nature. A group of students under a staff member can work on a single topic. However, each student has to submit his/her own Internship report independently and face the examination /presentation independently. Internship course shall be of 2 credits. Internship course report shall be valued for 50 marks (Internship report 25 Marks and presentation/ class room Seminar conducted by the mentor guid,25 marks).