SRI DHARMASTHALA MANJUNATHESHWARA COLLEGE (AUTONOMOUS)
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DEPARTMENT OF BOTANY

Syllabus of

Bachelor's Degree in

Science (BOTANY)

CHOICE BASED CREDIT SYSTEM

SEMESTER SCHEME

UNDER NEW EDUCATION POLICY 2020

2021-22 ONWARDS

(EFFECTIVE FROM ACADEMIC YEAR 2023-24)

BOS meeting held on 10-02-2024
Academic Council meeting, held on 23-03-2024

SDM COLLEGE (AUTONOMOUS), UJIRE DEPARTMENT OF BOTANY

SYLLABUS –FOUR YEARS UNDERGRADUATE PROGRAMME

The present situation necessitates transformation and/or redesigning of the system, not only by introducing innovations but developing a "learner-centric" approach. Thus, there is a need to allow flexibility in the education system, so that students depending upon their interests can choose inter- disciplinary, intra-disciplinary and skill-based courses. It is also to bridge the increasing gap between an undergraduate degree and employability.

Karnataka State Higher Education Council has proposed a model curriculum framework and an implementation plan for the State of Karnataka. Based on these recommendations, Mangalore University issued guidelines to its affiliated and autonomous colleges to implement the National Education Policy from the academic year 2021-2022. Hence, our college thought to implement multidisciplinary and holistic education in all the undergraduate programs with multiple entries and exit options with multiple certificate/diploma/degrees to replace the present undergraduate degree programs effective from the academic year 2021-2022.

The Department of Botany proposed a Four-year, Undergraduate Curriculum in Botany to cater to the needs of students with diverse talents, aspirations and professional requirements. Students will have the option to exit after one year with the certificate, two years with an award of the diploma and after three years with the award of the bachelor's degree. Successful completion of 4- year program will lead to the award of a bachelor degree with honours.

The salient features of the curriculum are as follows Discipline Core Course (DCC) Discipline Elective course (DEC) Discipline Open Elective (DOE)

Program objectives

- To enhance Subject knowledge of all branches of Botany with exposure to new andrecent developments in Botany.
- To develop Experimental skills/Communication and Learning skills
- To enable ICT exposure through computer simulation experiments/presentations
- To have Research exposure through SRPs
- To develop Additional skills in the field of interest.

- To develop Scientific approach in attitude and reasoning, creativity and innovativeideas
- To create Awareness on energy conservation/environment/cleanliness
- To develop Motivation on Nation development

Program outcomes

PO1: Skill development for the accurate description using botanical terms, identification, naming, and classification of life forms especially plants and microbes.

PO2: Acquisition of knowledge on the structure, life cycle, and life processes among plant and microbial diversity through certain model organism studies.

PO3: Understanding various interactions between plants and microbes; to develop the curiosity about the dynamicity of nature.

PO4: Skill development for collecting, preserving, and recording information after observation and analysis- from simple illustration to molecular database development.

PO5: Internalization of the concept of conservation and evolution through the channel of the spirit of inquiry.

PO6: To enable the graduates to prepare for national and international level competitive examinations like UGC-CSIR, UPSC, KPSC, etc.

PO7: The graduate should demonstrate sufficient proficiency in the hands-on experimental techniques for their area of specialization within biology during research and their professional care

COURSE PATTERN AND SCHEME

Semesters- I to IV

I Sem								
DCC	BYCT 101	Microbial Diversity and Technology	4	2	40	60	100	4
DCC	BYCP101	Microbial Diversity and Technology	4	4	25	25	50	2
DOE	BYOE101	Plant and Human welfare	3	2	40	60	100	3
II Sem								
DCC	BYCT 151	Diversity of Non-Flowering Plants	4	2	40	60	100	4
DCC	BYCP 151	Diversity of Non-Flowering Plants	4	4	25	25	50	2
DOE	BYOE 151	Plant Propagation, Nursery management and Gardening	3	2	40	60	100	3
III Sem								
DCC	BYCT201	Plant Anatomy and Development Biology	4	2	40	60	100	4
DCC	BYCP201	Plant Anatomy and Development Biology	4	4	25	25	50	2
DOE	BYOE201	Landscaping and Gardening	3	2	40	60	100	3
IV Sem								
DCC	BYCT 251	Ecology and Conservation Biology	4	2	40	60	100	4
DCC	BYCP 251	Ecology and Conservation Biology	4	4	25	25	50	2
DOE	BYOE 251	Landscaping and Gardening	3	2	40	60	100	3
		V Sem						
DCC	BYCT 301	Plant Morphology and Taxonomy	4	2	40	60	100	4
DCC	BYCP 301	Plant Morphology and Taxonomy	4	4	25	25	50	2
DCC	BYCT 302	Genetics and Plant Breeding	4	2	40	60	100	4

DCC	BYCP 302	Genetics and Plant Breeding Practicals	4	4	25	25	50	2
		VI Sem						
DCC	BYCT 351	Cell Biology	4	2	40	60	100	4
DCC	BYCP 351	Cell Biology Practicals	4	4	25	25	50	2
DCC	BYCT 352	Plant Physiology and Plant Biochemistry	4	2	40	60	100	4
DCC	BYCP 352	Plant Physiology and Plant Biochemistry Practicals	4	4	25	25	50	2

Outline for Internal assessment (Theory)

Activity	1	2	Total marks
Internals	10	10	20
Assignments/Quiz	10	10	20
Total	20	20	40

Allotment of Marks for Practicals for I-IV Semesters

Internal Assessment	
Lab performance based on Continuous assessment	10
Model practical examination after completing the minimum	15
Number of experiments	14
Total Marks.	**25**

B.Sc. BOTANY: SEMESTER - I

BYCT101: MICROBIAL DIVERSITY AND TECHNOLOGY

Course No.	Type of Course	Theory / Practical	Credits	Instruction hour per week	Total No. of Lectures/ Semester	Duration of Exam	Formative Assessment Marks	Summative Assessment Marks	Total Marks
BYCT 101	DCC	Theory	04	04	56 hrs	3hrs	40	60	100

Course Learning Outcomes (CO)

1. Understand the fascinating diversity, evolution, and significance of microorganisms.
2. Comprehend microbes' systematic position, structure, physiology, and life cycles and their impact on humans and the environment.
3. Gain laboratory skills such as microscopy, microbial cultures, staining, identification, preservation of microbes for their applications in research and industry.

Unit I 14 Hours

Chapter No. 1: 04 Hours

Microbial diversity-Introduction; 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 the soil, air, food, and water. Significance of microbial diversity in nature.

Chapter No. 2 05 Hours

History and development of microbiology-Microbiologists and their contributions (Leeuwenhoek, Louis Pasteur, Robert Koch, Joseph Lister, Dmitri Iwanowski, Sergius Winogradsky, and M W Beijerinck and Paul Ehrlich).

Chapter No. 3 05 Hours

Microscopy-Working principle and applications of light, darkfield, phase contrast, and electron microscopes (SEM and TEM). Microbiological stains (acidic, basic, and special) and Principles of staining- Simple, Gram and differential staining.

Self Study Components:

a. An overview of Pandemics. **b**. An account on Indian microbiologists. **c**. Sample preparation methods in Microscopy.

Chapter No. 4. **04 Hours**

Culture media for Microbes-Natural and Synthetic media, Routine media -basal media, enriched media, selective media, indicator media, transport media, and storage media.

Chapter No. 5. **05 Hours**

Sterilization methods:*Disinfection Methods* - Antiseptic, Tyndallization, and Pasteurization. *Physical methods*- dry heat, moist heat, UV light, ionization radiation, filtration. *Chemical methods* - Phenolic compounds, anionic and cationic detergents.

Chapter No. 6. **05 Hours**

Microbial Growth: Microbial growth and measurement. Nutritional types of Microbes - autotrophs and heterotrophs; phototrophs and chemotrophs; lithotrophs and organotrophs.

Self Study Components:

a. Study of Microbial growth Curve. **b**. Study of Microbial Metabolism.

Unit III **14 Hours**

Chapter No. 7. **06 Hours**

Microbial cultures and preservation, *Microbial cultures*- Pure culture and axenic cultures, subculturing. *Preservation methods*-Overlaying cultures with mineral oils, Lyophilization. *Microbial culture collections and their importance.* A brief account of ITCC, MTCC, and ATCC.

Chapter No. 8. **04 Hours**

Viruses: General structure, ICTV system of classification. Structure and multiplication of TMV, SARS- COV-2, and Bacteriophage (T2). Cultivation of viruses. Vaccines and types.

Self Study Components:

An account on Viral plant diseases (Disease, Causative virus, Host plant, and Important symptoms) Herbal Remedies for viral infections.

Chapter No. 9. **04 Hours**

Viroids- General characteristics and structure of Potato Spindle Tuber Viroid (PSTVd)

Prions - General characters and Prion diseases (**CJD**). Economic importance of viruses.

Chapter No. 10. **05 Hours**

Bacteria- General characteristics and classification.(Bergey's classification)

Archaebacteria and Eubacteria. Ultrastructure of Bacterial cell; Bacterial growth and nutrition. Reproduction in bacteria- asexual and sexual methods. Study of *Rhizobium* and its applications. A brief account of Actinomycetes. **Mycoplasmas and Phytoplasmas**- General characteristics and diseases.

Chapter No. 11. **07 Hours**

Fungi-General characteristics and classification (Alexopoulos classification). Thallus organization and nutrition.

Reproduction in fungi (asexual and sexual). Heterothallism and parasexuality. **Type study**: Morphology of *Phytophthora, Rhizopus, Puccinia, Penicillium,* and *Trichoderma*. Reproduction of *Phytophthora* and *Puccinia*. VAM Fungi and their significance.

Microbial plant diseases: Late Blight of Potato, Black stem rust of wheat; Downy Mildew of Bajra, Grain smut of Sorghum, Sandal Spike, Citrus canker.

Chapter 12. **02 Hours**

Lichens –Types, Structure, and reproduction. Economic importance

Self Study Components:

An Account of Edible Mushrooms

Text Books

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

References

1. Alexopoulos CJ and Mims CW. 1989. Introductory Mycology, Wiley Eastern Ltd., NewDelhi.
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 Cliffs.
4. Burnell JH and Trinci APJ. 1979. Fungal walls and hyphal growth, Cambridge UniversityPress. Cambridge.
5. Jayaraman J. 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. Michel J, Pelczar Jr.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.

Practicals: B.SC. BOTANY: SEMESTER - I

BYCP101: MICROBIAL DIVERSITY AND TECHNOLOGY

Course No.	Type of Course,	Theory / Practical	Credits	Instruction hour per week	Total No. of Lectures/ Semester	Duration of Exam	Formative Assessment Marks	Summative Assessment Marks	Total Marks
BYCP 101	DCC	Practical	02	04	56 hrs	3hrs	25	25	50

LIST OF EXPERIMENT 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, Haemocytometer, Micrometer.

Practical 2: Preparation of culture media (NA/PDA) sterilization, inoculation, incubation of *E. coli* / *B. subtilis*/ Fungi, and study of cultural characteristics.

Practical 3: Enumeration of soil/food /seed microorganisms by serial dilution technique.

Practical 4: Preparation of agar slants, inoculation, incubation, pure culturing, and preservation of microbes by oil overlaying.

Practical 5: Determination of cell count using Hemocytometer and microbial cell dimension determination using Micrometer.

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

Practical 7: Isolation and study of the 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 of any six: *Albugo, Phytophthora, Rhizopus/Mucor, Saccharomyces, Puccinia, Agaricus, Lycoperdon, Aspergillus/Penicillium, Trichoderma. (*Depending on local availability)

Practical 10: Study of late blight of Potato, Downy mildew of Bajra, Citrus canker, Tobacco mosaic disease, Sandal spike disease.

Practical 11: Studying well-known microbiologists and their contributions through charts and photographs.

Practical-12: Visiting water purification units/Composting/ microbiology labs/dairy and farms to understand the role of microbes in day-to-day life. The field study report is to be documented in the practical record.
(Note: Botanical study tour to a floristic rich area for 1-2 days and submission of the study report is compulsory)

Practical Exam pattern

Time: 3 hours **Marks:25**

Sl. No.	Question	Details	Mark distribution
1	List the materials required for the major experiment **A**, Write down the Procedure, set up the experiment & show the results. Draw the inference. Leave the set up for inspection	**As per the Lot** (anyone/student) Simple staining Gram's Staining Serial Dilution Haemocytometer	Aim-0.5 Requirement-0.5 Procedure with sketch-1 Performance-3 Result & Inference-1
2	Identify **B**, giving principle and uses.	Equipment/Tools used in microbiology	Identification-1 Working Principle-1 Uses-1
3	Identify the scientific personality **C** and mention any four significant contributions	Microbiologist and their contributions	Identification-1 Contribution-2
4	Identify the specimen **D**. Comment on its biological significance	Bacterial samples	Identification-0.5 Sketch-0.5 Significance-1
5	Identify the culture technique **E** and write its importance	Different types of Cultures, Culture methods, Inoculation methods	Identification-0.5 Sketch-0.5 Importance-1
6	Identify the slide **F** with reasons	Fungal types	Identification-0.5 Sketch-0.5 Reason-1
7	Identify the pathological specimen **G** giving the salient features	Pathology specimens	Disease – 0.5 Pathogen-0.5 Symptom-0.5 Control-0.5
8	CLASS RECORDS	Completeness Neatness	05

Open Elective: B.SC. BOTANY: SEMESTER – I

BYOE101: PLANTS AND HUMAN WELFARE

Course No.	Type of Course,	Theory / Practical	Credits	Instruction hour per week	Total No. of Lectures/ Semester	Duration of Exam	Formative Assessment Marks	Summative Assessment Marks	Total Marks
BYOE 101	DOE	Theory	03	03	42 hrs	2 hrs	40	60	100

Course Outcome:

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

1. To make the students familiar with the economic importance of diverse plants that offer resources to human life.
2. To make the students know about the plants used as food, medicinal value, and plant sources of different economic value.
3. To generate interest amongst the students on plants' importance in day-to-day life, conservation, ecosystem, and sustainability.

Unit I **14 Hours**

Origin of Cultivated Plants. Concept of Centres of Origin, their importance about Vavilov's work. Examples of major plant introductions. Crop domestication and loss of genetic diversity (Only conventional plant breeding methods). Importance of plant biodiversity and conservation.

Cereals: Wheat and Rice (origin, evolution, morphology, post-harvest processing & uses). Green revolution. A brief account of millets and their nutritional importance.

Legumes: General account (including chief pulses grown in Karnataka- red gram, green gram, chickpea, soybean). Importance to man and ecosystem.

Fruits: Mango, grapes, and Citrus (Origin, morphology, cultivation, processing, and uses)

Unit II **14 Hours**

Cash crops: Morphology, new varieties, and processing of sugarcane, products, and by-products of the sugarcane industry. Natural Rubber –cultivation, tapping, and processing.

Spices: Listing of important spices, their family and parts used, economic importance with special reference to Karnataka. Study of fennel, clove, black pepper, and cardamom.

Beverages: Tea, Coffee(morphology, processing & uses)

Oils and fats: General description, classification, extraction, their uses, and health implications; groundnut, coconut, sunflower and mustard (Botanical name, family & uses). Non-edible oil yielding trees and their importance as bio-fuel. Neem oil and applications.

Unit III **14 Hours**

Essential Oils: General account. Extraction methods of Sandalwood oil, Rose oil, and Eucalyptus oil. Economic importance as medicine, perfumes, and insect repellents.

Drug-yielding plants: Therapeutic and habit-forming drugs with special referenceto *Cinchona*, *Digitalis*, *Aloe vera*, and *Cannabis*.

Fibers: Classification based on the origin of fibers; Cotton and jute (origin, morphology, processing and uses).

Forests: Forest and forest products. Community forestry. Concepts of reserve forests, sanctuaries, and national parks concerning India. Endangered species and red data book.

Text Books and References

1. Kochhar, S.L. (2012). Economic Botany in Tropics. New Delhi, India: MacMillan & Co.
2. Wickens, G.E. (2001). Economic Botany: Principles & Practices.The Netherlands: Kluwer Academic Publishers.
3. Chrispeels, M.J., and Sadava, D.E. (1994) Plants, Genes and Agriculture.Jones& Bartlett - Publishers.

B.Sc. BOTANY: SEMESTER - II

BYCT 151: DIVERSITY OF NON-FLOWERING PLANTS

Course No.	Type of Course,	Theory / Practical	Credits	Instruction hour per week	Total No. of Lectures/ Semester	Duration of Exam	Formative Assessment Marks	Summative Assessment Marks	Total Marks
BYCT 151	DCC	Theory	04	04	56 hrs	2 hrs	40	60	100

Course Outcome:

1. Understand the diversity and affinities among Algae, Bryophytes, Pteridophytes, and Gymnosperms.
2. Understand the morphology, anatomy, reproduction, and life cycle across Algae, Bryophytes, Pteridophytes, and Gymnosperms and their ecological and evolutionary significance.
3. Obtain laboratory skills/explore non-flowering plants for their commercial applications.

Unit I **14 Hours**

Chapter No. 1 **05 Hours**

Algae –Introduction and historical development in algology. Distribution of Algae. General characteristics, classification of algae by Fritsch. Diversity- habitat, thallus organization, pigments, reserve food, flagella types, life cycle, and alternation of generation in Algae.

Chapter No. 2 **04 Hours**

Morphology and reproduction and life-cycles of *Nostoc, Scytonema, Oedogonium, Chara, Sargassum,*
and *Polysiphonia/Batrachospermum*. Diatoms and their importance.

Chapter No. 3 **05 Hours**

Algal cultivation- a general account. Cultivation of microalgae *Spirulina* and *Dunaliella*; Algal

products- Food and Nutraceuticals, Feedstocks, food colorants; fertilizers, aquaculture feed; therapeutics and cosmetics; medicines; dietary fibers from algae. Algal blooms and toxins.

Self-learning components:

Phylogenetic classification system of Algae.

Unit II **14 Hours**

Chapter No. 4. **02 Hours**

Bryophytes – General characteristics and classification (Rothmaler).

Chapter No. 5. **06 Hours**

Distribution, morphology, anatomy, reproduction, and life cycles of *Riccia*, *Anthoceros*, and *Funaria*. Ecological and economic importance of Bryophytes.

Chapter No. 6. **06 Hours**

Pteridophytes- General characteristics and classification (Smith); Distribution, morphology, anatomy, reproduction, and life-cycle in *Selaginella*, *Equisetum*, *Pteris*, and *Marselia*.

Unit III **14 Hours**

Chapter No. 7. **05 Hours**

Stelar evolution in Pterodophytes. A brief account of heterospory and seed habit. Affinities and evolutionary significance of Pteridophytes. Ecological and economic importance.

Chapter No. 8. **06 Hours**

Gymnosperms- General characteristics. Distribution and classification of Gymnosperms (Sporne). Study of the habitat, habit, anatomy, reproduction, and life-cycle in *Cycas, Pinus*, and *Gnetum*.

Chapter No. 9. **03 Hours**

Affinities and evolutionary significance of Gymnosperms. Economic importance of Gymnosperms - food, timber, industrial uses, and medicines.

Unit IV **14 Hours**

Chapter No. 10. **03 Hours**

Origin and evolution of Plants: Origin and evolution of plants through Geological Time scale.

Chapter No. 11. **07 Hours**

Paleobotany- Paleobotanical records, plant fossils, Types of plant fossils - impressions, compressions

, incrustation, actual remains petrifaction. Radiocarbon dating. A general account of fossil Bryophytes.

Chapter No. 12. **04 Hours**

Fossil taxa- *Rhynia, Lepidodendron, Cycadeoidea*. Contributions of Birbal Sahni. Birbal Sahni Institute of Palaeosciences.

Self Study Component:

Fossil taxa- *Rhynia, Lepidodendron, Cycadeoidea*.

Text Books

1) Chopra, G.L. A textbook of Algae. Rastogi & Co., Meerut, Co., New Delhi, Depot. Allahabad.
2) Johri, Lata and Tyagi, 2012, A Text Book of, Vedam eBooks, New Delhi.
3) Sharma, O.P. 1990. Text Book of Pteridophyta. McMillan India Ltd. New Delhi.
4) Sharma, O.P. 1992. Text Book of Thallophytes. McGraw Hill Publishing Co. New Delhi.

Practicals: B.SC. BOTANY: SEMESTER - II

BYCP 151: DIVERSITY OF NON-FLOWERING PLANTS

Course No.	Type of Course	Theory / Practical	Credits	Instruction hour per week	Total No. of Lectures / Semester	Duration of Exam	Formative Assessment Marks	Summative Assessment Marks	Total Marks
BYCP 151	DCC	Practical	02	04	56 hrs	2 hrs	25	25	50

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

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

Practical-3: Study of morphology, classification, reproduction, & life-cycle of *Marchantia/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/Salvinia*.

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 important ornamental ferns.

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 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 the study report is compulsory)

Sri Dharmasthala Manjunatheshwara College (Autonomous), Ujire.

B. Sc – II Semester, Botany Practical Examination Diversity of Non-flowering plants

Time: 3 Hrs **Max. Marks: 25**

1. Prepare a temporary slide of material **A** and **B**, Identify, Sketch, Label and comment on their characteristics. **2X2=4**

2. Identify the slides **C** and **D**, Write critical note on them. **2X2=4**

3. Identify the Specimens **E** and **F**. Write the classification, labelled sketch and comment on their characteristics. **2X2=4**

4. Identify the spotters **G** and **H**. Comment on their significance. **2X2=4**

5. Prepare a temporary slide of material **I**. Identify, Sketch, Label and comment on its characteristics. Leave the slide for inspection. **04**

6. Class records. **05**

SCHEME FOR VALUATION

A- Preparation: 2, ID ½. Classification-1/2, Diagram – 2 Total-5

(Material from gymnosperm or pteridophytes given in the syllabus)

B – ID ½, Classification-1/2, Reason – 2 Total-3

Material any algae mentioned in the syllabus.

C&D - ID ½, Dia-1/2, Cr notes-2 3x2=6

(Material any macroscopic form from bryophytes, pteridophytes, fossils, Ornamental ferns or gymnosperms)

E& F– ID ½, Diagram ½, Reasons -2. 3x2=6

(Slides: one from algae & bryophytes)

Class records: Total-5

Open Elective

B.SC. BOTANY: SEMESTER - II

BYOE151: PLANT PROPAGATION, NURSERY MANAGEMENT AND GARDENING

Course No.	Type of Course,	Theory / Practical	Credits	Instruction hour per week	Total No. of Lectures/ Semester	Duration of Exam	Formative Assessment Marks	Summative Assessment Marks	Total Marks
BYOE 151	DCC	Theory	02	04	42 hrs	2 hrs	40	60	100

Course Outcome:

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

1. To gain knowledge of gardening, cultivation, multiplication, raising of seedlings of garden plants.
2. To get knowledge of new and modern techniques of plant propagation.
3. To develop an interest in nature and plant life.

Unit I **14 Hours**

Nursery: Definition, objectives and scope and general practices and building up of infrastructure for nursery, planning and seasonal activities. Planting - direct seeding and transplants, Soil free/soilless/ synthetic growth mediums for pots and nursery.

Seed: Structure and types - Seed dormancy; causes and methods of breaking dormancy. Seed storage: Seed banks, factors affecting seed viability, genetic erosion, Seed production technology. Seed testing and certification.

Unit II **14 Hours**

Vegetative propagation: Air-layering, cutting, selection of cutting, collecting season, treatment of cutting, rooting medium, and planting of cuttings. Hardening of plants. Greenhouse, mist chamber, shed roof, shade house, and glasshouse.

Gardening: Definition, objectives, and scope. Different types of gardening - landscape and home/terrace gardening, parks and its components. Plant materials and design. Computer applications in landscaping,

Self study component: Ground layering, and Grafting.

Unit III **14 Hours**

Gardening operations: soil laying, Manuring, Watering, management of pests and diseases and harvesting. Sowing/raising of seeds and seedlings - Transplanting of seedlings - Study of cultivation of different vegetables and flowering plants: Cabbage, Brinjal, Lady's finger, Tomatoes, Carrots, Bougainvillea, Roses, Geranium, Ferns, Petunia, Orchids etc. Storage and marketing procedures. Developing and maintenance of different types of lawns. Bonsai technique.

Text Books and References

1. Agrawal, P.K. (1993). HandBook of Seed Technology. New Delhi, Delhi: Dept. of Agriculture and Cooperation, National Seed Corporation Ltd.
2. Bose T.K., Mukherjee, D. (1972). Gardening in India. New Delhi, Delhi: Oxford & IBH Publishing Co.
3. Jules, J. (1979). Horticultural Science, 3rd edition. San Francisco, California: W.H. Freeman and Co.
4. Kumar, N. (1997). Introduction to Horticulture. Nagercoil, Tamil Nadu: Rajalakshmi Publications. Additional Resources:

1. Musser E., Andres. (2005). Fundamentals of Horticulture. New Delhi, Delhi: McGraw Hill Book Co.
2. Sandhu, M.K. (1989). Plant Propagation. Madras, Bangalore: Wile Eastern Ltd.

B.Sc. BOTANY: Semester - III

BYCT201: PLANT ANATOMY AND DEVELOPMENT BIOLOGY

Course No.	Type of Course,	Theory / Practical	Credits	Instruction hour per week	Total Lectures/ Semester	Duration of Exam	Formative Assessment Marks	Summative Assessment Marks	Total Marks
BYCT 201	DCC	Theory	04	04	56 hrs	3hrs	40	60	100

Course Outcome:

On completion of this course, the students will develop the following skills:

1. Observation of variations that exist in the internal structure of various parts of a plant and among different plant groups in support of the evolutionary concept.
2. Skill development for properly describing internal structure using botanical terms, identification, and further classification.
3. Induction of enthusiasm for the internal structure of locally available plants.
4. Understanding various levels of organization in a plant body with an outlook on the relationship between structure and function through comparative studies.
5. Observation and classification of the floral variations from the premises of the 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

Unit 1: Plant Cells, Tissues, and Tissue systems **14 Hrs**

Introduction, objectives and scope of Plant Anatomy; General structure of plant cells; structure of plant cell wall.

Tissue and tissue systems - Definitions, structure, and functions of Meristematic tissues and permanent tissues (Simple and Complex). A brief account of plant secretary tissues/cells. Concept of tissue systems - Ground tissues, Dermal tissues, and Vascular tissues. **Classification of meristems**: Based on location (apical, intercalary, and lateral), Origin (promeristem, primary and secondary meristem), and function (protoderm, procambium, and ground meristem). **Apical meristems*:*** Generalised structure of shoot apex, theories on the organization of Shoot apical

meristem (SAM) - Apical cell theory, Tunica-Corpus theory, and Histogen theory. Generalized structure of root apex, theories on the organization of root apical meristem (RAM) – Apical Cell Theory, Histogen theory, Quiescent center theory, and Korper – Kappe theory.

Unit II: Primary and Secondary anatomy of Angiosperms 14 Hrs

Primary anatomy of root: Dicot (*Tridax*/Sunflower), monocot (Maize). **Primary stem anatomy**: Dicot (*Tridax*/Sunflower), Monocot (Maize), Nodal anatomy. **Anatomy of leaf**: Dicot (*Tridax*/Sunflower), Monocot (Maize). Types of trichomes and stomata. **Secondary Growth**: Normal Secondary growth in stem and root (*Tridax*/Sunflower). Anomalous secondary growth in *Aristolochia, Boerhaavia (*dicot stem*),* and *Dracaena* (monocot stem). **Applications of anatomy in Plant systematics, forensics, and Pharmacognosy.**

Unit III: Differentiation and Morphogenesis in Plants 14 Hrs

Introduction to differentiation and morphogenesis (definitions and significance in plant growth and development). Concept of totipotency and de-differentiation. Differentiation and cell polarity in acellular (*Dictyostelium*), Unicellular (*Acetabularia*), and multicellular plant systems (*Arabidopsis*). **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. **Leaf development**: Mechanism of leaf primordium initiation, development, and Phyllotaxis, Diversity in size, shape, and arrangement of leaves. **Structure and function of root apical meristem (RAM)**: Root cap, quiescent center, and origin of lateral roots. **Flower development**: Overview of flower initiation and development, Genetic control of flower development - ABC model of flower development. Senescence in plants – a general account.

Unit IV: Reproductive Biology 14 Hrs

Introduction, Scope, & **Contributions of Indian embryologists**: P.Maheswari, BGL Swamy, M.S. Swaminathan, and K.C. Mehta.

Microsporangium: Development and structure of mature anther; Anther wall layers; Tapetum - types, structure, and functions; sporogenous tissue. **Microsporogenesis** - Microspore mother cells, microspore tetrads, and their types; Pollinia. **Microgametogenesis** – Formation of vegetative and generative cells, the structure of male gametophyte. Pollen embryosac (Nemec phenomenon). **Megasporangium –** Structure of typical Angiosperm ovule.Types of ovules- Anatropous, Orthotropous, Amphitropous, Campylotropous, Circinotropous. **Megagametogenesis –**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; Significance of double fertilization, Post fertilization changes. **Endosperm:** Biological importance & Types. Free nuclear (*Cocos nucifera*), cellular (*Cucumis),* and helobial types. Ruminate endosperm. **Embryogenesis:** Dicot (*Capsella bursa-pastoris),* and Monocot (*Najas)* embryo development. Structure of Dicot and Monocot seed.

Self Study components: Contributions of Indian embryologists: T.S. Sadashiva and Ramdeo Misra.

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 - McGraw 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
21. T Pullaiah, K C Naidu and K Lakhminarayana, 2017. Plant Development. Daya Publishing House, New Delhi.
22. Online Resources: https://onlinecourses.nptel.ac.in/noc19_bt17/preview

Practicals: B.SC. BOTANY: SEMESTER – III BYCP201: PLANT ANATOMY AND DEVELOPMENT BIOLOGY

Course No.	Type of Course	Theory / Practical	Credits	Instruction hour per week	Total Hours / Semester	Duration of Exam	Formative Assessment Marks	Summative Assessment Marks	Total Marks
BYCP 201	DCC	Practical	02	04	56 hrs	3hrs	25	25	50

LIST OF EXPERIMENT TO BE CONDUCTED

Practical No.1: i) Study of the meristem (Permanent slides/ Photographs).

ii) Study of Simple Tissues: Parenchyma, Collenchyma, and Sclerenchyma

Practical No.2: Complex Tissues - xylem and phloem; Maceration technique to study vascular tissues.

Practical No. 3:Study of the primary structure of dicot and monocot stem

Practical No.4: Study of the primary structure of dicot and monocot root and leaf

Practical No.5: 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.6: Study of trichomes (any three types) and stomata (any three types) with the help of locally available plant materials

Practical No.7: Permanent slides of Microsporogenesis and male gametophyte Mounting of Pollen grains of Grass and *Hibiscus* and Pollinia of *Calotropis*

Practical No.8: Pollen germination (hanging drop method) and Effect of Boron and Calcium on pollen germination

Practical No.9: Permanent slides of types of ovules, Megasporogenesis and embryosac development.

Practical No.10: Types of placentation: Axile, Marginal and Parietal types. Sectioning of the ovary for the studied types of placentation

Practical No.11: Mounting of the embryo: Any locally available seeds. *Tridax* and *Cyamopsis*, Mounting of endosperm: *Cucumis*

Practical No. 12: Histochemical localization of proteins/ carbohydrates

Practical No. 13 and 14:

Mini project work in groups of 3-5 students, from the following list to be recorded on practical record

a) Study of pollen morphology of different flowers for shape, color, aperture, etc.
b) Pollen germination of different pollen grains and calculates the percentage of germination.
c) Calculating the germination percentage 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.

B.Sc. BOTANY: SEMESTER III

PRACTICAL: DISCIPLINE SPECIFIC CORE COURSE (DCC) BYCP201: PLANT ANATOMY AND DEVELOPMENT BIOLOGY

Question Paper Pattern and Scheme of evaluation

Time: 2 hrs. **Max. Marks: 25**

1. Prepare a temporary stained section of the material **A**. Sketch, label, and identity. Leave the preparation for inspection. 05
2. Calculate the percentage of pollen germination/mounting of an embryo or pollinia **B.** 04
3. Sketch, label, and identity with reasons **C, D,** and **E.** 09
4. Practical Record with project work 5+2=07

Sl. No.	Question	Experiment	Marks allotment	
1	A		Preparation 02 Labelled Sk 02 Identification 01 Total 05	Reg. No. of Candidates Assigned Reg. No. of absentees: Total examined: Examiners: 1. External 2. Internal
2	B		Preparation 01 Procedure 01 Calculation/diagram 02 Total 04	
3	**C D E**		Labelled Sk 01 Identification 01 Reasons 01 03 each	
4		Practical Record Project work	05 02	

Note:

A: Dicot/Monocot stem or root

B: Pollen of *Vinca, Impatiens*/ *Calotropis*/mustard or any locally available seed **C, D** and

E: Permanent slide on tissue types/ placentation/ovule types/anther/ leaf anatomy

B.Sc. BOTANY – III SEMESTER BYOE201: LANDSCAPING AND GARDENING

Course No.	Type of Course	Theory / Practical	Credits	Instruction hour per week	Total No. of Lectures / Semester	Duration of Exam	Formative Assessment Marks	Summative Assessment Marks	Total Marks
BYOE201	DOE	Theory	03	03	42 hrs	2hrs	40	60	100

Learning outcomes:

After the completion of this course, the learner will be able to:

- Apply the basic principles and components of gardening
- Conceptualize flower arrangement and bio-aesthetic planning
- Design various types of gardens according to the culture and art of bonsai
- Distinguish between formal, informal and freestyle gardens
- Establish and maintain special types of gardens for outdoor and indoor landscaping

Unit I **14 lectures**

Principles of gardening, garden components, adornments, lawn making, methods of designing rockery, water garden, etc. Special types of gardens, their walk paths, bridges, constructed features, their design, and values in landscaping. planting trees, shrubs, and herbaceous perennials. climbers and creepers, palms, ferns, grasses and succulents, greenhouse.

Unit II **14 lectures**

Flower arrangement: importance, production details, cultural operations, constraints, post-harvest practices. Bio-aesthetic planning, definition, Town and country planning, urban planning, and planting avenues in schools, villages, railway stations, dam sites, hydroelectric stations, colonies, river banks, and playgrounds.

Unit III **14 lectures**

Vertical gardens, roof gardens. Culture of bonsai, the art of making bonsai. Parks and public gardens. Landscape designs, Styles of the garden, formal, informal, and freestyle gardens, types of gardens, Urban landscaping, Landscaping for specific situations, institutions, industries, residents, hospitals, roadsides, traffic islands, dam sites, IT parks, corporate. Establishment and maintenance, special gardens, Bio-aesthetic planning, eco-tourism, indoor gardening, therapeutic gardening, non-plant components, water-scaping, xeriscaping, hardscaping; Computer

Aided Designing (CAD) for outdoor and indoor scaping Exposure to CAD (Computer Aided Designing).

Suggested Readings

1. Berry, F. and Kress, J. (1991). Heliconia: An Identification Guide. Smithsonian Books
2. Butts, E. and Stensson, K. (2012). Sheridan Nurseries: One hundred years of People, Plans, and Plants. Dundurn Group Ltd.
3. Russell, T.(2012). Nature Guide: Trees: The world in your hands (Nature Guides).

B.Sc. BOTANY - SEMESTER IV

BYCT251: ECOLOGY AND CONSERVATION BIOLOGY

Course No.	Type of Course	Theory / Practical	Credits	Instruction hour per week	Total Lectures/ Semester	Duration of Exam	Formative Assessment Marks	Summative Assessment Marks	Total Marks
BYCT 251	DCC	Theory	03	03	56 hrs	3hrs	40	60	100

Unit I 14 lectures

Introduction to Ecology and Conservation Biology: Definitions, Principles of Ecology, Brief History, Major Indian Contributions, Scope, and importance. Ecological levels of the organization.

Ecological factors: Climatic factors: light, temperature, precipitation, and humidity.

Edaphic factors: Soil & its types, soil texture, soil profile, soil formation; Physico-chemical properties of soil mineral particles, soil pH, soil aeration, organic matter, soil humus, and soil microorganisms.

Topographic Factors: Altitude. **Ecological groups of plants & their adaptations**: Morphological & anatomical adaptations of hydrophytes, xerophytes, epiphytes, & halophytes.

Unit II 14 lectures

Ecosystem Ecology: Introduction, types of ecosystems with examples -terrestrial &aquatic, natural & artificial.

Structure of ecosystem: Biotic and Abiotic components, detailed structure of a pond ecosystem.

Ecosystem functions and processes: Food chain-grazing and detritus; Food web.

Ecological pyramids -Pyramids of energy, biomass, and number. Principles of Energy flow in the ecosystem.

Bio-geo chemical cycles: Gaseous cycles -carbon and nitrogen, Sedimentary cycle-Phosphorus.

Ecological succession: Definition, types; primary & secondary.

General stages of succession: Hydrosere & xerosere.

Community Ecology: Community and its characteristics: frequency, density, Abundance, cover & basal area, phenology, stratifications, and life forms. Concept of Ecotone and Ecotypes. Intra-

specific and Inter-specific interactions with examples.

Unit III **14 lectures**

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.

Population Ecology: Population and its characteristics – Population density, natality, mortality, age distribution, population growth curves, and dispersal.

Phytogeography and Environmental issues: 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.

Vegetation types of Karnataka – Composition and distribution of evergreen, semi-evergreen, deciduous, scrub, mangroves, shola forests, and grasslands. An account of the vegetation of the Western Ghats.

Pollution: Water pollution: Causes, effect, types; water quality indicators, water quality standards in India, control of water pollution (Wastewater treatment).

Water pollution disasters – National mission on clean Ganga, Minimata, Pacific gyre garbage patch, Exxon Valdez oil spill.

Air pollution: Causes, effects, air quality standards, acid rain, control.

Soil pollution: Causes, effect, solid waste management, and control measures.

Unit IV **14 lectures**

Biodiversity and its conservation: Biodiversity: Definition, types of biodiversity - habitat diversity, species diversity and genetic diversity, Global and Indian species diversity. SDGs (Sustainable Developmental Goals) in biodiversity conservation.

Values of Biodiversity – Economic and aesthetic value, Medicinal and timber-yielding plants. NTFP. Threats to biodiversity. Concept of Biodiversity Hotspots, Biodiversity hot spots of India. Concept of endemism and endemic species. ICUN plant categories with special reference to Karnataka/ Western Ghats.

Biodiversity Conservation- Indian forest conservation act, Biodiversity bill (2002). Conservation methods – *In-situ* and *ex-situ* methods. *In-situ* methods –Biosphere reserves, National parks, Sanctuaries, Sacred grooves. *Ex-situ* methods-Botanical gardens, Seed banks, Gene banks, Pollen banks, Culture collections, Cryopreservation.

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.

Practicals: B.Sc. BOTANY:

Semester - IV BYCP251: ECOLOGY AND CONSERVATION BIOLOGY

Course No.	Type of Course	Theory / Practical	Credits	Instruction hour per week	Total Hours / Semester	Duration of Exam	Formative Assessment Marks	Summative Assessment Marks	Total Marks
BYCP 251	DCC	Practical	02	04	56 hrs	3hrs	25	25	50

LIST OF EXPERIMENT TO BE CONDUCTED

Practical No.1: Determination of pH of different types of Soils, Estimation of salinity of soil/water samples.

Practical No.2: Study of Ecological instruments – Wet and Dry thermometer, Altimeter, Hygrometer, Soil thermometer, Rain Gauge, and Barometer.

Practical No. 3:Hydrophytes: Morphological adaptations in *Pistia, Eichhornia, Hydrilla, Nymphaea*. Anatomical adaptations in *Hydrilla*(stem) and *Nymphaea* (petiole).

Practical No.4: Xerophytes: Morphological adaptations in *Asparagus, Casuarina, Acacia, Aloe vera, Euphorbia tirucalli*. Anatomical adaptations in phylloclade of *Casuarina*.

Practical No.5: Epiphytes: Morphological adaptations in *Acampe*, *Bulbophyllum, Drynaria*.Anatomical adaptations in the epiphytic root of *Acampe*/ *Vanda*.

Halophytes: the study of Vivipary in mangroves, Morphology, and anatomy of Pneumatophores.

Practical No.6: Examining and recording the various biotic and abiotic components of a pond/forest ecosystem.

Practical No.7: Demonstration of different vegetation sampling methods; transects and quadrats. Determination of Density & frequency.

Practical No.8: Application of remote sensing to vegetation analysis using satellite imageries.

Practical No.9: Field visits to study different types of local vegetation/ecosystems and the report to be written in the practical record book.

Practical No.10: Determination of water holding capacity of soil samples

Practical No.11: Determination of Biological oxygen demand (BOD)

Practical No. 12: Determination of Chemical oxygen demand (COD)

Practical No. 13: Determination of soil texture of different soil samples.

Practicals: B.Sc. BOTANY SEMESTER IV BYCP251: ECOLOGY AND CONSERVATION BIOLOGY

Question Paper Pattern and Scheme of evaluation

Time: 2 hrs.Max. Marks: 25

1. Prepare a stained temporary mount of the T.S. of material **A**. Draw a neat labeled diagram. Leave the slide for inspection.	05
2. Determine the water holding capacity/ BOD/ COD/ pH/ texture/ salinity of soil/ water sample	05
3. Identify the ecological instrument **C,** Describe its working mechanism. Mention any one uses	04
4. Identify the ecological group of **D** and **E**. Comment on their ecological features/ adaptation	06
5. Practical Record with field visit report	05

Sl. No.	Question	Experiment	Marks allotment	
1	A		Preparation 03 Labelled diagram 02 Total 05	Reg. No. of Candidates Assigned

2	B		Requirements 01 Procedure 02 Setting 01 Result 01 Total 05	Reg. No. of absentees: Total examined: Examiners: 1. External 2. Internal
3	**C**		Identification 01 Working principle 02 Use 01 Total 04	
4	**D E**		Ecological group 01 Features 02 03each	
		Practical Record Filed visit report	05	

Note: **A**: Plant material from the ecological group must be selected

Courses from V and VI Semesters for the Undergraduate Program in BOTANY

Sem. No.	Course Category	Course Code	CourseTitle	Credits Assigned	Instructional hoursperweek		Duration of Exam (Hrs.)	Exam/Evaluation Pattern (Marks)		
					Theory	Practical		IA	Exam	Total
V	DSC	BOTC9-T	Plant Morphology and Taxonomy	4	4		2	40	60	100
		BOTC10-P	Plant Morphology and Taxonomy	2		4	3	25	25	50
		BOTC11-T	Genetics and Plant Breeding	4	4		2	40	60	100
		BOTC12-P	Genetics and Plant Breeding	2		4	3	25	25	50
		BOTC15-T	Plant Physiology and Biochemistry	4	4		2	40	60	100
		BOTC16-P	Plant Physiology and Biochemistry	2		4	3	25	25	50

Open Electives fornon-BOTANY

Studentsarealsotodesignedandcontentsdraftedforthefirstthreesemesterswithmultipleoptions.

Note:

1. If any Elective or Vocational course involves theory-cum-practical (2+1 credit), then IA to Exam Marks will be in the ratio of 50:50. The practicalpartistobeevaluatedaspartofIA.Semesterendexaminationisonly intheorycomponent and questions frompracticalpart, ifany.

C11,C12,C13andC14-papermodelsyllabusgiven belowisdesignedforsinglemajorthereforeC11&C13consistsof3creditsand C12,C14 containsthe related practical syllabus respectively. University BoS who choose double major will have to include 4 credit syllabus (one extra unit) for C11 and C13 papers along with the practical experiments in their respective practical papers (C12, C14)

1. Plant Morphology and Taxonomy(Theory)

Program Name	**B.Sc.in BOTANY**	Semester	**V**
Course Title	**Plant Morphologyand Taxonomy (Theory)**		
Course Code:	BYCT 301	No.of Credits	**04**
Contact hours	**60 Hours**	Durationof 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. Understand the main features in Angiosperm evolution

CO2.Identify,classifyanddescribeaplantinscientificterms,thereby,Identificationofplantsusing dichotomouskeys.Skilldevelopmentinidentificationandclassificationofflowering plants.

CO3.InterprettherulesofICNinbotanicalnomenclature.

CO4. Classify Plant Systematic and recognize theimportance of herbarium and Virtual Herbarium, Evaluatethe important herbaria and botanical gardens.

CO5.Recogniselocallyavailableangiospermfamilies,economicallyimportantplants.Appreciationofhuman activities in conservation of useful plants from the past to the present.

Contents	**60Hrs**
Unit1:	**15hrs**
MorphologyofRoot,StemandLeaf. Their modifications for various functions. Inflorescence – types. Structure and variations of flower.Fruits–types. Floraldiagramandfloral formula. **Introduction to Taxonomy**: History, objectives, scope andrelevanceof Taxonomy **Systems of classification**: Artificial, Natural and Phylogenetic; brief account of Linnaeus', Bentham & Hooker's, Engler and Prantl's system and APG IV System (2016) - Merits anddemerits of classification. **Taxonomicliteratures:**Floras,Monograph,Revisions,Journals. **HerbariaandBotanicalgardens:**Importantherbariaandbotanicalgardensof theworld and India. Technique of Herbarium Preparation and role of botanical gardens.	

Virtualherbarium; E-flora;Documentation.	
Unit 2:	**15hrs**
Taxonomic Hierarchy: Concept of taxa (family, genus, species); Categories and taxonomic hierarchy; Species concepts (biological, morphological, evolutionary). Modes of speciation. Problems with species concepts. Rankless system of phylogenetic systematics. **BotanicalNomenclature:**Principlesandrules(ICN);Latestcode–briefaccount,Brief accountofRanksoftaxa,Typeconcept(Typification),Ruleofpriority,Authorcitation., valid publication, rejection of names, principle of priority and its limitations; Names of hybrids/cultivated species. **Plant identification**: Taxonomic dichotomous keys; indented (yoked) andbracketedkeys. (brief account only).	
Unit3:	**15hrs**
Plant descriptions and diagnostic features of Angiosperm families: Common Terminologies used for description of vegetative and reproductive parts of the following plantfamilies:**Brassicaceae,Malvaceae,Anacardiaceae,Fabaceae(withsub-Families), Cucurbitaceae, Apiaceae, Rubiaceae, Asteraceae, Apocynaceae, Solanaceae, Lamiaceae, Amaranthaceae, Euphorbiaceae**	
Unit4:	**15hrs**
Plant descriptions and diagnostic features of Angiosperm families: **Orchidaceae, Liliaceae, Arecaceae and Poaceae**. **Biometrics, Numerical Taxonomy; Phenetics and Cladistics:** Characters; Variations; OTUs, character weighting and coding; Cluster analysis; Phenograms, cladograms (definitions and differences). **Originandevolutionofangiosperms;**Co-evolutionofangiospermsandanimals;Methods of illustrating evolutionary relationship (phylogenetic tree, cladogram). **Moleculartaxonomy :**DNAsequencesofchloroplastgenes(*atp*B,rbcL,ITS,trnL)andone nuclear gene (nuclear ribosomal 18s DNA).	

CourseTitle	**Plant Morphology and Taxonomy(Practical)**	PracticalCredits	**02**
Course Code	BYCP 301	ContactHours	**56Hours**
FormativeAssessment	**25Marks**	SummativeAssessment	**25Marks**

PracticalContent(4hrseachsession)

1. Study of root, stemand leaf structure and modifications.
2. Studyofinflorescencetypes.Studyofflowerandits parts.
3. Studyoffruits.Floraldiagramandfloral formula.

4-10. Study of 14 families* with suitable diagrams, technical terms (description, V.S. flower, section of ovary,floraldiagram,floralformulaand systematicpositionaccordingtoBentham&Hooker'ssystemof classification).

11-13. 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, Horsegram,Blackgram,Bengalgram,Indigo,Brinjal,Tomato,Chilly,Tamarind,Bittergourd,Asafoetida, Cumin, Coriander, Coffee, Rubber, Castor, Ginger, Turmeric, Coconut coir, Arecanut, Rice, Wheat, Ragi, Sugarcane, Periwinkle, Sarpagandha, Adusoge.

14.**Fieldvisit**:Localoroutside/BotanicalGarden/tribalsettlements.

Submission: Recordbook,TourreportandHerbarium(any2).

*Dicotyledons–any12;Monochlamydae-any1;Monocotyledons-any2

Pedagogy: Teaching andlearning,conductingexperiments,fieldvisits

FormativeAssessmentforTheory	
AssessmentOccasion/type	**Marks**
Test	20
Assignments	10
Seminar	10
Total	**40Marks**
Formative Assessmentasper NEPguidelines ar ecompulsory	

Pedagogy: Teachingandlearning,conductingexperiments,field/Lab.Visits

FormativeAssessmentforPractical	
AssessmentOccasion/type	**Marks**
Attendance	05
Test	10
Submission(Recordbook,Tourreport)	10
Total	**25Marks**
FormativeAssessmentasperNEPguidelinesarecompulsory	

GENERAL PATTERN OF THEORY QUESTION PAPER

(60marksforsemesterendExaminationwith2hrsduration)

Part-A

1. Questionnumber01-12carries2markseach.Answerany10questions: 20marks.

Part-B

2. Questionnumber13-20carries10Markseach.Answerany04questions: 40marks.

(Minimum1questionfromeachunitand10marksquestionmayhavesub-questionsfor7+3or6+4)

Total: 60 Marks Note: Proportionateweight-age shall begiven to each unitbased on numberof hoursprescribed.

SCHEMEOFPRACTICALEXAMINATION

(Distributionofmarks):25marksfortheSemesterendexamination

1.	Identify,classifyanddescribethespecimenA&Btaxonomically	6Marks
2.	ExplainthespecimenCusingtechnicalterms	4Marks
3.	Writethefloraldiagramandfloralformalofthegivenspecimen D	2Marks
4.	IdentificationofSpecimen/slidesE,F,GandH	8 Marks
5.	Submission(Journal/Record+twoherbarium)	5Marks
	Total :	**25marks**

Generalinstructions:

Q1. A-Specimen from Dicotyledons,B-Monochlamydae/MonocotyledonsQ2. Give specimen from the family they studied (C)

Q3.Givespecimenfromthefamilytheystudied(D)

Q4. Specimen /Slides/ materials from Root/Stem/Inflorescence (E), Flower/Fruit (F) and Economic importance (G & H)

Q5.Submission(Journal/Record+twoherbarium)

Note:SameSchememaybeusedforIA(FormativeAssessment)examination

References	
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11	Lawrence-*TaxonomyofVascular Plants* -Oxford&IBH,NewDelhi.
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16	Pandey,S.N,andS.P.Misra(2008)-*TaxonomyofAngiosperms*- AneBooksIndia, NewDelhi.
17	RadfordAB,WCDickison,JMMassey&CRBell,*VascularPlantSystematics*,1974,Harper & Row Publishers, New York.
18	SinghG.2012.*Plantsystematics:TheoryandPractice*.OxfordandIBH,Pvt.Ltd.,NewDelhi.
19	SinghV.&Jain-*TaxonomyofAngiosperms*-RastogiPublications,Meerut.
20	SivarajanV.V-*Introduction toPrinciples oftaxonomy*-Oxford&IBH NewDelhi.
21	Anylocal/state/regionalflorapublishedbyBSIoranyotheragency.
22	MorphologyofAngiosperms–John MerieCoulterandCharles, MJP Publishers,03-03-2023
23	TaxonomyofAngiospers–S.N.Pandey,AneBooks Pvt.Ltd.2019-10-05

Genetics and Plant Breeding (Theory)

ProgramName	**B.Sc.in BOTANY**	Semester	**V**
CourseTitle	**Genetics and Plant Breeding (Theory)**		
Course Code:	**BYCT 302**	No.of Credits	**04**
Contacthours	**60Hours**	Durationof SEA/Exam	**2hours**
Formative AssessmentMarks	**40**	Summative AssessmentMarks	**60**

CoursePre-requisite(s):	
CourseOutcomes(COs):Afterthesuccessfulcompletionofthecourse,thestudentwillbeableto: CO1.Understand the basics of genetics and plant breeding CO2.Identify,calculateanddescribecrossingover, allelicgenerations andfrequencies ofrecombination. CO3.Interpret the results of mating and pollinations. CO4.ClassifyPlantpollinationmethods CO5.Recognisemodesofinheritanceoftraits/phenotypesandPhenotype-genotypecorrelation.	
Contents	**60Hrs**
Unit1:	**15hrs**
Mendeliangeneticsanditsextension: History;Principlesofinheritance:lawofsegregation,lawofindependentassortment. Testcrossandbackcross,Autosomesandsexchromosomes;Probabilityand pedigree analysis. Incomplete dominance (*Mirabilis*) and Codominance (Rhododendron); Multiple alleles (self-sterility in tobacco), Lethal alleles (Snapdragon), Epistasis- 9:7, 9:3:4, 12:3:1, 15:1. Brief account on Pleiotropy, Penetrance and Expressivity. Polygenicinheritance(kernelcolorinwheat)	
Unit2:	**15hrs**

Extra chromosomal inheritance, Chloroplast mutation: Variegation in Four o'clock plant;Mitochondrial mutations in yeast. **Linkage and crossing over** – types, Cytological basis of crossing over; Recombination frequency, two factor and three factor crosses; Interference and coincidence. **MechanismsofsexdeterminationinPlants**–*Melandrium,Cocciniaindica*and *Maize.* **Variationinchromosomenumber**:Aneuploidyanditstypes,Euploidyandits types.Polyploidy inplants:Auto andallopolyploids- naturalandartificialwith examples, significance of polyploidy.	
Unit3:	**15hrs**
Chromosomal Aberrations: Types and cytological consequences of Deletion, Duplication, Inversion and translocation. **Structure of Gene**: Cistron, recon and muton concept. Prokaryotic and eukaryotic genes. Genetic code and its properties **Genemutations**,Typesofmutations-Spontaneous,Induced; MolecularbasisofMutations(basesubstitutionsandframeshiftmutations);Mutagens – physical and chemical (Base analogs, deaminating, alkylating and intercalating agents); Role of Transposons in mutation. **PopulationandEvolutionaryGenetics:**Allelefrequencies,Genotypefrequencies, Hardy-WeinbergLaw,geneticdrift.	
Unit4:	**15hrs**
PlantBreeding:Introductionandobjectives,Scope Importantachievements andundesirable consequences ofplant breeding. **Methods of crop improvement:** Introduction, Acclimatization; Selection methods: Mass line, Pure line, Clonal. **VegetativePropagationinplants**:LayeringandGrafting **Malesterility**-Types,productionandsignificanceinplantbreeding. **Hybridization**:Methods,Types,AdvantagesandLimitations. Role of mutations in Plant breeding, Roleofbiotechnologyincropimprovement-Transgenicplants.	

CourseTitle	**Genetics and Plant Breeding (Practical)**	Practical Credits	**02**
CourseCode	**BYCP 302**	ContactHours	**56 Hours**
FormativeAssessment	**25 Marks**	SummativeAssessment	**25 Marks**

PracticalContent(4hrseachsession)

1. Vegetativere production methods-Cutting, Layering
2. Grafting and its methods.
3. Hybridization:Emasculation,bagging,pollinationandproductionofhybrids
4. EstimationofpercentageofPollenviability/Pollenfertility.
5. Mendel'slawsthroughseedratios(monohybrid,dihybrid,testcrossandback cross)
6. Laboratoryexercisesinprobabilityandchi-square.
7. Chromosomemappingusingpointtestcrossdata.
8. Geneticproblems:IncompletedominanceandPolygenic inheritance.
9. Geneticproblems:Geneinteractions(9:7,9:3:4)
10. Geneticproblems:Geneinteractions(12:3:1, 15:1)
11. Determination of linkage and cross-overanalysis(throughtwo/threepointtestcross data)
12. Study of aneuploidy:TrisomyinDaturausingphotographs.
13. Chromosomalaberrations: Translocation Ring, Laggards and Inversion Bridgeusing photographs.
14. Visittonursery/Plantbreedingstations/KVKs.

Pedagogy:Teachingandlearning,Seminar,Assignments,etc

FormativeAssessmentforTheory	
AssessmentOccasion/type	**Marks**
Test	20
Assignments	10
Seminar	10
Total	**40Marks**
FormativeAssessmentasperNEPguidelinesarecompulsory	

Pedagogy: Teachingandlearning,conductingexperiments,field/Lab.Visits

FormativeAssessmentforPractical

AssessmentOccasion/type	Marks
Attendance	05
Test	05
Fieldvisit	05
Submission	10
Total	**25Marks**
FormativeAssessmentasperNEPguidelinesarecompulsory	

GENERAL PATTERN OF THEORY QUESTION PAPER

(60 marks for semester end Examination with 2 hrs duration) Part-A

1. Questionnumber1-12carries2markseach.Answerany12questions: 20marks

Part-B

2. Questionnumber13-20carries10Markseach.Answerany04questions: 40marks

(Minimum1questionfromeachunitand10marksquestionmayhavesub-questionsfor7+3or6+4)

Total: 60Marks Note: Proportionateweightageshallbe given to each unit based on numberof hoursprescribed.

SCHEMEOFPRACTICALEXAMINATION

(Distributionofmarks):25marksfortheSemesterendexamination

1. Performthepollenviability/fertilityofthegivensample**A** 6Marks
2. Solvethe givengeneticproblems**BandC** 8Marks
3. IdentificationofSpecimen/slides/Photographs**C,D**and**E** 6Marks
4. Submission(Journal/Record) 5Marks

Total : 25marks

Generalinstructions:

Q1Material Cassia/Vinca/Ipomia/Hibiscus (A)Q2 Genetic problems (B & C)

Q3. Layering/Grafting/Emasculation/bagging–C;TrisomyinDatura,linkageand cross-over, Translocation Ring, Laggards and InversionBridge (D and E)

Q4.Submission(Journal/Record)

Note:SameSchememaybeusedforIA(FormativeAssessment)examination

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10	Chopra,V.L.(2000). PlantBreeding:TheoryandPractice2ndEd.Oxford&IBH,NewDelhi.
11	FundamentalsofGenetics –6thedition2022- B.D.Singh
12	FundamentalsofGenetics&MolecularBiology–Dr.VishnuShankar Sinha.

Semester - VI

351- Cell Biology (Theory)

Program Name	B.Sc. in BOTANY	Semester	VI
Course Title	Cell Biology (Theory)		
Course Code:	DSC-BOT - C13-T	No. of Credits	04
Contact hours	60 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. Understand of Cell metabolism, chemical composition, physiochemical and functional organization of organelle

CO2. Learn the contemporary approaches in modern cell and molecular biology.

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

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

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

Contents	60Hrs
Unit 1:	**15hrs**
Cell as a unit of structure and function, Characteristics of prokaryotic and eukaryotic cells, Cell wall - distribution, chemical composition, functions, and variations in prokaryotic and eukaryotic cells (primary and secondary wall), Glycocalyx, Cell- cell interactions/Junctions. Cell membrane-Structure and functions, active and passive transport, proton pumps associated (Na-K, Ca-calmodulin etc. and their distribution), phagocytosis, pinocytosis, exocytosis. Structure, function and biogenesis of mitochondria and chloroplast, An account of transport in mitochondria and chloroplasts (Tim/Tom; Tic/Toc) and semiautonomous nature of mitochondria and chloroplast. Brief account on different types of plastids.	

Unit 2:	**15hrs**
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; Ribosomes, peroxisomes, Lysosomes and Vacuoles. Nuclear envelope, structure of nuclear pore complex, nuclear lamina, transport across nuclear membrane, Nucleolus, Ergastic substances.	
Unit 3:	**15hrs**
Chromosomes: Size and number of chromosomes, Gross and ultra structure, types of chromosomes based on the position of centromere, Heterohromatin, euchromatin, paranemic and plectonemic coils, autosomes and allosomes, karyotype and idiogram, properties and functions of chromosomes. Brief account of supernumerary chromosomes in plants. Phases of eukaryotic cell cycle, Process of mitosis and meiosis; significance, Regulation of cell cycle- checkpoints, role of protein kinases. Concept of Programmed Cell Death. Signal Transduction: Receptors and primary and secondary signal transduction, pathway.	
Unit 4:	**15hrs**
DNA as the carrier of genetic information – Griffith experiment, Avery, McCarty and MacLeod experiment, Hershey - Chase experiment DNA: Chemical composition, types - A, B and Z DNA, structure-Watson & Crick model, Semiconservative replication. RNA: Structure and functions of mRNA, tRNA and rRNA. Gene Expression: Transcription and Translation in prokaryotes, process of Gene splicing. Regulation of gene expression in prokaryotes- Lac operon model. Gene regulation in eukaryotes- transcriptional and post-transcriptional.	

Course Title	**Cell Biology (Practical)**	Practical Credits	**02**
Course Code	**DSC-BOT - C14-P**	Contact Hours	**56 Hours**
Formative Assessment	**25 Marks**	Summative Assessment	**25 Marks**

Practical Content (4hrs each session)

1. Study of plant cell structure with the help of epidermal peel mount of Onion/Rhoeo
2. Study of cell and its organelles with the help of electron micrographs/Photographs
3. Measurement of length and breadth of plant cell using micrometry (Using Onion or Rheo leaf cells).
4. To demonstrate the effect of heat on permeability of cell membrane of beet root cells.
5. Study of different concentrations of alcohol on cell membrane permeability
6. Study of ergastic substances - starch (potato), aleurone (wheat grain), calcium oxalate (Pistia), calcium carbonate (Ficus leaf) and oil globules (castor seed).
7. Study of mitosis by squash technique using Onion root tip cells
8. Study of meiosis using Rheo / Onion flower buds
9. Observation of permanent slides of mitosis and meiosis
10. Study of mitotic index from suitable plant material
11. Estimation of total chlorophyll in leaves
12. Demonstration of DNA isolation from plant cells
13. Study of Karyotype using chart.
14. Techniques of preparation of permanent and semi-permanent cytological slides

Pedagogy: Teaching and learning, Seminar, Assignments, etc

Formative Assessment for Theory	
Assessment Occasion/type	**Marks**
Test	20
Assignments	10
Seminar	10
Total	**40 Marks**
Formative Assessment as per NEP guidelines are compulsory	

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

Formative Assessment for Practical	
Assessment Occasion/type	**Marks**
Attendance	05
Test	05
Field visit	05
Submission	10
Total	**25Marks**
Formative Assessment as per NEP guidelines are compulsory	

GENERAL PATTERN OF THEORY QUESTION PAPER

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

Part-A

1. Question number 01-12 carries 2 marks each. Answer any 10 questions: 20 marks. Part-B

2. Question number 13-20 carries 10 Marks each. Answer any 04 questions: 40 marks. (Minimum 1 question from each unit and 10 marks question may have sub-questions for 7+3 or 6+4)

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: 03 hrs Marks: 25

1. Prepare a squash of onion root tip, Identify and explain any one stage with a labelled diagram. 06 marks
2. Find out the cell length and breadth of a given material using Micrometry/Estimation the total amount of chlorophyll (B) 06 marks
3. Identify the slides/ cell organelles C, D, E & F 08 marks
4. Submission (Journal/ Record) 05 marks

Total 25 marks

General instructions:

Q1. Give specimen from Onion root tip
(A)
Q2. Give pecimen sample (B)
Q3. Give one slide each from mitosis, meiosis, ergastic substances (C), (D) and (E),
one photograph of a cell organelle (F)
Q4. Submission (Journal/ Record)

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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9	Molecular biology of the cell by Albert Bruce 6th edition. 2014

PLANT PHYSIOLOGY AND PLANT BIOCHEMISTRY (THEORY)

ProgramName	**BSc/ BOTANY**	Semester	**VI**
CourseTitle	**Plant Physiology and Plant Biochemistry (Theory)**		
CourseCode:	**BYCT 351**	No.ofCredits	**04**
Contacthours	**60 Hours**	DurationofExam	**2 hours**
FormativeAssessmentMarks	**40**	Summative Assessment Marks	**60**

Course Pre-requisite(s):	
Course Outcomes(COs):Afterthesuccessfulcompletionofthecourse,thestudent will be able to: CO1.AscertaintheImportanceofwaterandthemechanismoftransport. CO2. Explain the biosynthesis and breakdown of biomolecules. CO3.Interprettheroleofplanthormonesinplantdevelopmentandaboutsecondarymetabolites. CO4.Perceivethebasicfunctionsandmetabolisminaplantbody. CO5.Understandtheimportanceofnutrientsinplantmetabolismandcrop yield.	
Contents	**60 Hrs**
UNIT1	**15 Hrs**
Plantwaterrelations:Mechanismofwaterabsorption,Factorsaffectingwater absorption. **Mechanismofascentofsap:**Vitalandphysicalforcetheories. **Transpiration.** Types and process. Mechanism of guard cell movement. K+ ion exchange mechanism. Antitranspirants. Guttation. **Translocationoforganicsolutes:**Transportoforganicsolutes.pathoftransport,veinloading and unloading. Transcellular hypothesis, mass flow hypothesis. **Mineral nutrition:** Essential elements: Classification - Macro and Micronutrients. Functions and deficiency symptoms of macro elements- N, P, K and Mg. Functions and deficiency symptoms of Micronutrients-Zn, Mn and B. Hydroponics and its applications. Mechanism of mineral salt absorption: Passive absorption – diffusion, ion exchange. Active absorption- Cytochrome pump theory, Protein Lecithin theory.	

UNIT2	15 Hrs
Enzymes-classification,kineticsandmechanismofaction. **Bioenergetics:**Definition,examplesformajorbioenergeticprocesses. **Photosynthesis**:PhotosyntheticPigments(Chla,b,xanthophylls,carotene);PhotosystemI and II, reaction center, antenna molecules; Electron transport and mechanism of ATP synthesis; C3, C4 and CAM pathways of carbon fixation; Photorespiration. **Respiration**: Glycolysis, TCA cycle; Oxidative phosphorylation, Glyoxylate cycle, Oxidative Pentose Phosphate Pathway. Anaerobic respiration – alcoholic and lactic acid fermentation. ATP yield during aerobic and anaerobic respirations. Respiratory quotient.	
UNIT3	**15Hrs**
Plant growth regulators: Definition and classification, Role of Auxins, Gibberlins, cytokinins, ABA and ethylene on plant growth and development. Practical utility in agriculture andhorticulture, Synthetic growth regulators. **SensoryPhotobiology**: Biological clocks, photoperiodism, function & structure of phytochromes, phototropins & cryptochromes. **Plant movements**: Nastic movements – nyctinasty, chemo nasty and seismonasty. Tropic movements –phototropic, hydrotropic, geotropic and thigmotropic. **Dormancy in plants:** Definition and types. Bud dormancy - induction and breaking. Seed dormancy – causes and methods of breaking.	
UNIT4	**15Hrs**
Carbohydrate metabolism – Classification of Carbohydrates. Structure of ribose and deoxyribosesugars,glucose,fructose,sucrose,starchandcellulose,Metabolismofsucroseand starch. **Nitrogen metabolism** - Sources of nitrogen, physical and biological nitrogen fixation and mechanism of biological nitrogen fixation- asymboitic and symbiotic, formation of root nodules in Leguminous plants, Nitrate reduction and amino acid synthesis. **Fatmetabolism** - Generalaccountof fats,synthesis ofglycerol,synthesis offattyacids,and condensationoffattyacidandglycerol,fatdegradation,β(Beta) -oxidation,glyoxylatecycle and its significance, plant waxes **Secondary plant products**: structure,biosynthesisanddistributionofterpenes, phenolics and nitrogencontainingcompounds.	

Course Title	**Plant Physiology and Biochemistry (Practical)**	Practical Credits	**2**
Course Code	BYCP 351	Contact Hours	**4 Hours**
Formative Assessment	**25 Marks**	Summative Assessment	**25 Marks**

Practical Content

Major Experiments:

1. Todeterminetheosmoticpressureofthecellsapbyplasmolyticmethod.
2. Todemonstraterootpressure/transpiration pullinplants.
3. Todemonstratethatoxygenisliberatedintheprocessofphotosynthesis.
4. Separationofphotosyntheticpigments bypaperchromatographyandmeasuretheirRfvalues.
5. Toisolateandidentifytheaminoacidsfrom amixtureusingpaper chromatography.
6. DeterminationofRQofgerminatingseedsusingGanong'sRespirometer.
7. QualitativetestforStarch,Protein,ReducingSugars,and Lipids.
8. Estimationofcarbohydrates
9. Estimationofproteins
10. EstimationofTAN(TitratableacidNumber)fromBryophllumleaves/AloeVera..

Minor experiments:

11. Experimenttodemonstratethephenomenonofexosmosisandendosmosisbypotatoosmoscope and thistle funnel experiment.
12. StudyofPhototropism,hydrotropismand geotropism
13. a)DemonstrationoffermentationusingKuhn'sfermentationvessel
    b)Measurementof lineargrowthofaplantusingarcauxanometer
14. Tocomparetherateoftranspirationfromthetwosurfacesofleafbycobaltchloridepapermethod

Pedagogy:Teachingandlearning,Seminar,Assignments,etc

FormativeAssessmentforTheory	
AssessmentOccasion/type	**Marks**
Test	20
Assignments	10
Seminar	10
Total	**40Marks**
FormativeAssessmentasperNEPguidelinesarecompulsory	

Pedagogy: Teachingandlearning,conductingexperiments,field/Lab.Visits

FormativeAssessmentforPractical	
AssessmentOccasion/type	**Marks**
Attendance	05
Test	05
Fieldvisit	05
Submission	10
Total	**25Marks**
FormativeAssessmentasperNEPguidelinesarecompulsory	

GENERAL PATTERN OF THEORY QUESTION PAPER

(60marksforsemesterendExaminationwith2hrsduration)

Part-A

1. Questionnumber01-12carries2markseach.Answerany10questions:20marks.

Part-B

2. Question number 13-20 carries 10 Marks each. Answer any 04 questions: 40 marks.

(Minimum 1question fromeach unitand 10marksquestionmayhave sub-questionsfor7+3or 6+4)

Total:60Marks

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

SCHEMEOFPRACTICALEXAMINATION

PLANTPHYSIOLOGYANDPLANTBIOCHEMISTRY

Time=03hrs	**Marks=25**
1. ConductMajorExperimentA	06marks
2. CommentonminorExperimentsB&C	06marks
3. MicroChemicaltestD	03marks
4. Estimationofproteins/carbohydrates/TAN	05marks
5. PracticalRecord	05marks

REFERENCES

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