Revised Curriculum for M.Sc. in Botany

UNDER

CHOICE BASED CREDIT SYSTEM (CBCS)

(Effective from 2018 -19)

Lalit Narayan Mithila University
Darbhanga

OUTLINE OF THE CHOICE BASED CREDIT SYSTEM (CBCS) for PG degree courses:

It consists of a number of courses i.e. Core Course (CC), Elective Course (EC), Discipline Specific Elective Course (DSE), Ability/Skill Enhancement Courses (AEC/SEC), and Ability Enhancement Compulsory Courses (AECC). Each course is equivalent to a paper. The nature of these courses is defined below:

1.**1 Core Course (CC):**
A course which should compulsorily be studied by a candidate as a core requirement on the basis of subject of M.Sc. studies and is termed as a Core course.

1.2. Elective Course (EC):
Generally a course which can be chosen from a pool of courses (Basket) and which may be very specific or specialized or advanced or supportive to the subject/ discipline of study or which provides an extended scope or which enables an exposure to some other subject/discipline/domain or nurtures the candidate's proficiency/skill is called an Elective Course.

1.3 Discipline Specific Elective Course (DSE):
Elective courses may be offered by the main discipline/subject of study is referred to as Discipline Specific Elective. The University/ institute may also offer discipline related Elective courses of interdisciplinary nature (to be offered by main discipline/subject of study).

1.4 Generic Elective (GE) Course:
An elective course chosen generally from an unrelated discipline/subject, with an intention to seek exposure is called a Generic Elective.

1.5 Ability Enhancement Courses (AEC/SEC):
The Ability Enhancement Courses (AEC) / Skill Enhancement Courses (SEC). "AEC/SEC" is the courses based upon the content that leads to life skill enhancement.

1.6 Ability Enhancement Compulsory Courses (AECC):
University will run a number of Ability Enhancement Compulsory Courses (AECC) which is qualifying in nature and student from all faculties have to qualify in all such courses.

1.7 Dissertation/Project/ Internship/Industrial Training/ Field Work:

Elective courses are designed to acquire advanced knowledge to supplement/support the main subject through project work/ internship/ industrial training/ field work. A student studies such a course on his/her own with mentoring support by a teacher / faculty member called the guide/supervisor. In case of internship/ industrial training the student will work under the joint Guidance of one teacher-supervisor from the parent department to be termed as Supervisor-1 and one suitably qualified personnel at the research institute/ research laboratory/ industrial organization, to be termed as Supervisor-2. A student may join any recognized research institute/ research laboratory/ the industrial organization with the approval of parent department. The student has to work for a minimum number of days/ hour as decided by the parent department. On completion of the project work/ training at the research institute/ research laboratory/ industrial organization, student will submit a written project report certified by both supervisors to the parent department. Supervisor-2 will issue a letter certifying that the candidate has successfully completed the project and also award marks/ grade to him/ her. The certificate will be submitted to the parent department confidentially. The Board of Courses of Studies (BOCS) of the concerned subject/

department will draft and design the certificate and other documents as per requirement. The parent department will also assist the students to choose proper organizations for their project work/ industrial training/ field work etc. The student can also do Project dissertation work in parent department on selected topic under the supervision of teacher of the department.

2.0 CREDIT

The total minimum credits, required for completing a PG program is 100. The details of credits for individual components and individual courses are given in Table.1.

Table 1: Structure of the 2 Yrs (Four Semesters) Post Graduate Degree course under CBCS:

Semester	No of Course / paper	Credit per Course / paper	Total credit	Minimum No. of Learning Hours	No of CORE COURSE/ PAPER	No of ELECTIVE COURSE / PAPER	Code and Nature of Elective Course / paper
I	5	5	25	250	4	I	AECC-1
			SEMESTER BREAK				
II	6	5	30	300	5	1	AEC-1
			SEMESTER BREAK				
III	6	5	30	300	5	1	AECC-2
			SEMESTER BREAK				
IV	3	5	t5	150	0	4	EC.1* EC2* DSE-I or GEI
Total	**20**		**100**	**1000**	**t4**	**6**	

#For Tutorial (T)/ Practical (P)/ Field Work (FW)/ Internship etc. extra working hour to be added as per requirement and will be decided by the BOCS of the respective subject.

* The two Elective Courses (EC)to be studied in semester lV may be
One Theory paper and One Practical paper

/One Theory paper and One Project work
/ Both Project work/ Internship

IMP : It is desirable that all students of all courses be given adequate exposure over and above the class room teaching to enhance the scope of skill development/ entrepreneurship and employability.

2.1. There shall be six elective courses - two EC, one DSE or one GE, two AECC, one AEC/SEC. Students may opt for any elective course out of a list of elective papers (Basket) offered by the parent department or any other department/s as per his/her choice with the prior permission of the parent department. The list of elective papers, syllabus and prerequisite of the elective course will be as decided by the Board of Courses of Studies (BOCS) of the concerned subject/ department. All elective course listed may not be available in all semesters. Based on the availability of resource persons and infrastructure the parent department will assist the students to select elective courses of their choice.

2.2. The final CGPA/ class will be decided on the performance of the student in the 16 courses/papers including the 14 Core Courses (CC) / papers and two Elective Courses (EC)/ papers.

2.3. The one DSE or one GE, two AECC, one AEC/SEC papers will be qualifying in nature and a student has to score at least 45% marks in these papers. Grade will be awarded separately for these courses, however, performance in these elective courses/ papers will not be considered for awarding the final CGPA/ class.

2.4. Ability Enhancement Compulsory Courses (AECC):

University will run two Ability Enhancement Compulsory Courses (AECC) which are qualifying in nature and a student has to qualify in both these courses. The courses are:

AECC-1
Environmental Sustainability (3 Credit) & Swachchha Bharat Abhiyan Activities (2 credit)

AECC-2

Human Values & Professional Ethics (3 credits) and Gender sensitization (2 credits)

Student will do assignments/project work related to institutional social responsibilities including swachchha Bharat Abhiyan activities during SEMESTER BREAK.

2.5. University will run a number of Ability Enhancement Courses (AEC)/ Skill Enhancement Courses (SEC); a student can choose one from these. For example:
Basket of Ability Enhancement or Skilled Enhancement Courses (AEC/SEC)

- Computers and lT Skill
- Financial Risk Management/
- Solid waste Management/
- Mushroom Culture /
- Bio-fertilizerproduction/
- Environmental Law/
- Tourism and Hospitality Management/
- Yoga Studies

etc.

2.6 Discipline Specific Elective (DSE):
ln each subject the CC-5 being taught in the second semester will be open to be selected as a DSE paper. In the first phase a student will be allowed to choose a paper from any subject other than his/ her Core Course (CC) from the same faculty in the same university.

2.7 Generic Elective (GE) Course:
University will run a number of Generic Elective Courses (GE); a student can choose one from these. For example:
Basket of Generic Elective (GE) courses

- Music
- Dramatics
- Fine Arts
- Graphic Design
- Inclusive Policies
- Human Rights
- Any such course run by any department

Name of the Programme: M.Sc. Botany (Choice Based Credit System)

(Four Semester programme)

PROGRAM OBJECTIVES:

1. To promote interest, participation and commitment in the subject Botany.
2. To acquire competencies in theoretical as well as experimental Botany in order to enhance knowledge in Plant Science and to further contribute for the development of the society.
3. To strengthen aptitude for research in basic plant science and its interdisciplinary areas.
4. To prepare the students to successfully compete for employment in academia, agriculture, horticulture and need based industry.
5. To help students develop integrity and objectivity and disseminate the knowledge for scientific, economic and social benefit, hence contributing towards national and global development.

Course Structure for M.Sc. Botany

Course Structure for M.Sc. Botany

Semester	Course/Paper code	Nature of Course / Paper	Credit	Marks	Marks of CIA	Marks of ESE	Passing criterion	Qualifying Criterion
SEMESTER I	MBOTCC-1	Phycology, Mycology and Bryology	5	100	30	70	45% CIA 45% in ESE	Marks deciding class / CGPA
	MBOTCC-2	Microbiology and Plant Pathology	5	100	30	70	45% CIA 45% in ESE	Marks deciding class / CGPA
	MBOTCC-3	Pteridophyta, Gymnosperm and Paleobotany	5	100	30	70	45% CIA 45% in ESE	Marks deciding class / CGPA
	MBOTCC-4	Practical 1 (Based on MBOTCC 1,2 &3)	5	100	30	70	45% CIA 45% in ESE	Marks deciding class / CGPA
	MBOTAECC-1	Environmental Substainability & wachchha Bharat Abhiyan Activities	5	100	50	50	45% CIA 45% in ESE	Qualifying
SEMESTER II	MBOTCC-5 DSE-1 for other Department	Biofertilizer Technology	5	100	30	70	45% CIA 45% in ESE	Marks deciding class / CGPA
	MBOTCC-6	Taxonomy & Anatomy & Embryology	5	100	30	70	45% CIA 45% in ESE	Marks deciding class / CGPA
	MBOTCC-7	Physiology and Biochemistry	5	100	30	70	45% CIA 45% in ESE	Marks deciding class / CGPA
	MBOTCC-8	Plant Tissue Culture, Ethanobotany, Biodiversity & Biometry	5	100	30	70	45% CIA 45% in ESE	Marks deciding class / CGPA
	MBOTCC-9	Practical 2 (Based on MBOTCC 5,6, 7 & 8)	5	100	30	70	45% CIA 45% in ESE	Marks deciding class / CGPA
	MBOTAEC-I / SEC - I	Ability Enhancinn Elective course selected from Basket	5	100	50	50	45% CIA 45% in ESE	Qualifying
SEMESTER III	MBOTCC-10	Cell Biology & Cytogenetics	5	100	30	70	45% CIA 45% in ESE	Marks deciding class / CGPA
	MBOTCC-11	Molecular Biology	5	100	30	70	45% CIA 45% in ESE	Marks deciding class / CGPA
	MBOTCC-12	Recombinant DNA Technology	5	100	30	70	45% CIA 45% in ESE	Marks deciding class / CGPA
	MBOTCC-13	Plant Ecology & Environmental Science	5	100	30	70	45% CIA 45% in ESE	Marks deciding class / CGPA
	MBOTCC-14	Practical 3 (Based on MBOTCC 10, 11, 12, & 13)	5	100	30	70	45% CIA 45% in ESE	Marks deciding class / CGPA
	MBOTAECC-2	Human Values & Professional Ethics and Gender Sensitization	5	100	50	50	45% CIA 45% in ESE	Qualifying
SEMESTER IV	MBOTEC-1	Subject specific elective	5	100	30	70	45% CIA 45% in ESE	Marks deciding class / CGPA
	MBOTEC-2	Subject specific elective	5	100	30	70	45% CIA 45% in ESE	Marks deciding class / CGPA
	MBOTDSE-1	Opt a Course from other Department	5	100	30	70	45% CIA 45% in ESE	Qualifying

M.Sc. Botany

(Semester-I)

MBOTCC-I: Phycology, Mycology and Bryology (5 Credits)

Time: 3hrs **Marks: 70**

The question paper will consist of 7 questions divided into 3 sections.

Section A: Question No.l will be compulsory comprising ten objective types questions (two from each Unit) each carrying two marks (10 x 2 : 20 marks).

Section B: Question No. 2 will also be compulsory and comprise five short answer types questions (one from each Unit) and students will have to attempt only four questions (4 x 5: 20marks).

Section C: Five long answer types questions are to be set (one from each Unit) of which any three questions are to be answered (3 x 10:30 marks).

Unit I

Thallus organization of algae, Cell ultra-structure and Reproduction: Vegetative, asexual and sexual. Role of pigments, reserve food, cell wall, flagella, eye spot and pyrenoids in classification and evolution of algae. Use of algae as food, feed and in industry. lndian phycologists and their contributions

Unit II

Salient features of Chlorophyta, Charophyta, Xanthophyta, Bacillariophyta, Phaeophyta and Rhodophyta

Unit III

General characters of fungi, Cell ultra structure, unicellular and multicellular organization, cell wall composition, nutrition (saprobic, biotrophic, symbiotic), reproduction (Asexual and Sexual), Heterothallism, Parasexuality. Classification of fungi: Recent trends (with reference to Ainsworth 1973 and Alexopoulus and Mins 1979).

Unit IV

Brief account of Ascomycotina, Basidiomycotina, Deuteromycotina. Fungi in industry, medicine and as food. Fungi as biocontrol agents

Unit V

Classification and general features of Marchantiales and Jungermanniales, Anthocerotales, Sphagnales and Polytrichales. Vegetative propagation and perennation in Bryophytes. Evolution of Sporophytes in Bryophytes

M.Sc. Botany
(Semester-I)

MBOTCC-2: Microbiology and Plant Pathology (5 Credits)

Time: 3hrs **Marks: 70**

The question paper will consist of 7 questions divided into 3 sections.

Section A: Question No. 1 will be compulsory comprising ten objective types questions (two from each Unit) each carrying two marks (10x2=20 marks).

Section B: Question No. 2 will also be compulsory and comprise five short answer types questions (one from each Unit) and students will have to attempt only four questions (4 x 5:20marks).

Section C: Five long answer types questions are to be set (one from each Unit) of which any three questions are to be answered (3 x 10:30 marks).

Unit I
General introduction; History and scope of microbiology. Methods of microbiology: Sterilization-Different types of sterilization (moist heat, dry heat, filtration, radiation and chemicals). Diversity of microorganisms: Archaea, Bacteria, Cyanobacteria, Phytoplasma

Unit II
Structure of bacteria: Ultra structure of Gram positive and Gram negative bacteria; reproduction (vegetative, asexual and genetic sexual recombination); economic importance of bacteria. Viruses: Nature, characteristics and ultrastructure of Virions (TMV and Bacteriophages), multiplication (Lytic and Lysogenic cycles) and transmission of viruses

Unit III
Agriculture Microbiology: Biological nitrogen fixation and Biofertilizer. Industrial Microbiology: Industrial production of organic acids (citric acid), antibiotics (penicillin) and enzymes (amylase)

Unit IV
Classification of Plant disease and appearance of symptoms due to different microbes. Role of enzyme and toxin in pathogenesis. Host defence mechanism with special reference to structural and biochemical defence

Unit V
Seed pathology with special reference to seed-borne mycoflora, mycotoxin and its hazard Quarantine regulation and seed certification. Etiology, symptoms and control measures of the following plant diseases: Rust of linseed, Leaf blight of maize, Tikka disease of groundnut, Bunchy top of banana, black tip of mango, Yellow vein mosaic of bhindi, Little leaf of brinjal and Citrus canker

M.Sc. Botany

(Semester-I)

MBOTCC-3: Pteridophyta, Gymnosperm & Paleobotany (5 Credits)

Time: 3hrs **Marks: 70**

The question paper will consist of 7 questions divided into 3 sections.

Section A : Question No.l will be compulsory comprising ten objective types questions (two from each Unit) each carrying two marks (10 x 2 = 20 marks).
Section B : Question No. 2 will also be compulsory and comprise five short answer types questions (one from each Unit) and students will have to attempt only four questions (4 x 5=20marks).
Section C: Five long answer types questions are to be set (one from each Unit) of which any three questions are to be answered (3 x 10:30 marks).

Unit- I
Classification of Pteridophytes. Detailed general features: vegetative and reproductive, with special reference to development, characterization, position and kind of protection provided to the spore producing organs of the sporophytes and sexuality of the gametophytes in the following classes/orders: Psilopsida – Psilotales. Lycopsida - Lycopodiales, Selaginellales and Isoetales. Special discussion has to be made about: Stelar evolution within Lycopodiales. Heterospony vs. seed habit, with special reference to Selagineilales

Unit- II
Sphenopsida -Equisetales (only a brief account) Pteropsida. Characterization, classification and distinction between Eusporangiate, Protoleptosporangiatae and Leptosporagiatae. Structure, reproduction and Phylogenetic considerations of the followings: Eusporangiate - Ohioglossales. Leptosporangiatae - Marsiliales , Salviniales. Special reference has to be made about the followings: Economic importance of pteridophytes

Unit-Ill
Characteristic features, distribution and economic importance of gymnosperrns Classification of Gymnosperms. Comparative morphology, anatomy, reproductive structures and interrelationships of the following living orders : Cycadales, Ginkgoales, Taxales

Unit- IV
Coniferales: Characteristic features, families of modern conifers, their distribution and economic importance. Comparative account of reproductive structures of Ephedrals, Gnetales, Welwitschiales. Phylogenetic relationship, angiospermic feature and evolutionary significance of order Ephedrales and Gnetales.

Unit-V

Types and Nomenclature of fossils; Fossilization process and geological time-scale; Principles and objectives of fossil study. Comparative morpholory, anatomy, reproductive structure and affrnities of the following : fossil groups: Psilophytales, Cordaitales, Pentoxvlales

M.Sc. Botany

(Semester-I)

MBOTCC-4: Practical 1 (Based on MBOTCC 1,2 & 3) (5 Credits)

Time: 5hrs **Marks: 70**

1. Principles and use of different sterilization instruments like autoclave. oven. Laminar air flow system etc.
2. Preparation of media (Potato Dextrose Agar).
3. Isolation of fungi from soil.
4. Identification of fungal isolates.
5. Preparation of Nutrient Agar (NA) media.
6. Isolation of bacteria from water.
7. Characterization of bacterial isolate by Gram's staining.
8. Counting of fungal spore by haemocytometer.
9. Temporary slide preparation and study of common Algae.
10. Temporary slide preparation and study of common Fungi.
11. Study of vegetative habit, anatomy and reproductive morphology of common Bryophyta (*Marchantia, Anthoceros* etc.)
12. Study of vegetative habit, anatomy and reproductive morphology of common Pteridophyta (*Psilotum, Lycopodium, Ophioglossum, Marsilea* etc.).
13. Study of vegetative habit, anatomy and reproductive morphology of common Gymnosperm (*Cycas, Pinus, Ginkgo, Gnetum* etc.).
14. Study of common fungal diseases- Rust of linseed, Blight of potato, Rust of wheat, Stem gall of coriander, Downy mildew, Powdery mildew etc.

M.Sc. Botany

(Semester- II)

MBOTCC-S: Biofertilizer Technology (5 Credits)

Time: 3hrs Marks: 70

The question paper will consist of 7 questions divided into 3 sections.

Section A: Question No.l will be compulsory comprising ten objective types questions (two from each Unit) each carrying two marks (10x2:20 marks).

Section B: Question No. 2 will also be compulsory and comprise five short answer types questions (one from each Unit) and students will have to attempt only four questions (4 x 5:20marks).

Section C: Five long answer types questions are to be set (one from each Unit) of which any three questions are to be answered (3 x l0:30 marks).

Unit l

Introduction to biofertilizers - Structure and characteristic features of the following biofertilizer organisms: Bacteria: *Azospirillum, Azotobacter, Rhizobium* and Frankia; cyanobacteria; *Anabaena*. *Nostoc*; Fungi: *Glomus* etc..

Unit-II

Nitrogenous Biofertilizers: Bacteria - Isolation and purification of *Azospirillum* and *Azotobacter*, mass multiplication of *Azospirillum* and *Azotobacter*, formulation of inoculum of *Azospirillum* and *Azotobacter*, application of inoculants of *Azospirillum* and *Azotobacter*. Isolation and purification of *Rhizobium*, mass multiplication and inoculum production of *Rhizobium*, Methods of application of *Rhizobium* inoculants.

Unit-III

Isolation and purification of Cyanobacteria- Mass multiplication of cyanobacterial bioinoculants - Trough or Tank method, Pit method, Field method; methods of application of cyanobacterial inoculum. *Azolla* - mass cultivation and application in rice fields.

Unit-IV

Myconhizae - Ecto and endomycorrhizae and their importance in agriculture. Isolation of AM fungi - Wet sieving method and sucrose gradient method. Mass production of AM inoculants and field applications. Isolation and Purification of phosphate solubilizers. Mass multiplication and field applications of phosphate solubilizer (*Pseudomonas striata*).

Unit-V

Biofertilization processes -Decomposition of organic matter and soil fertility and vermicomposting Biofertilizers: Storage, shelf life, quality control and marketing

M.Sc. Botany
(Semester-II)

MBOTCC-6: Taxonomy, Anatomy & Embryology (5 Credits)

Time: 3hrs **Marks: 70**

The question paper will consist of 7 questions divided into 3 sections.

Section A: Question No.1 will be compulsory comprising ten objective types questions (two from each Unit) each carrying two marks (10x2:20 marks).

Section B: Question No. 2 will also be compulsory and comprise five short answer types questions (one from each Unit) and students will have to attempt only four questions (4 x 5:20marks).

Section C: Five long answer types questions are to be set (one from each Unit) of which any three questions are to be answered (3 x l0:30 marks).

Unit-I
Classification: A historical account of Pre-Linnaean, Linnaean, Post-Linnaean and Pre-Darwinian Natural Systems and Post-Darwinian Phylogenetic Systems contemporary Systems: Arthur cronquist, Armen Takhatajan

Unit II
Concept of taxa: Species, sub-species, variety and form; genus, family and higher categories
Concept of characters: 'Good'and 'Bad' characters, correlation of characters, character weighting And variation

Botanical nomenclature: Binomial system and International Code of Botanical Nomenclature (ICBN)

Unit III
Post Mendelian approaches: An introduction to Genecology, Experimental, taxonomy
Cytotaxonomy, Biosystematics, Palynotaxonomy, Chemotaxonomy,

Unit IV
Differentiation, dedifferentiation, redefferentiation, polarity and symmetry of meristems. Organization of shot apical meristem (SAM). Organization of root apial meristem (RAM). Differentiation of Epidermal tissue with reference ot stomata and appendages. Anatomical features and significance of nodal anatomy and floral anatomy

Unit V
Development of ovule, megasporogenesis and organization of female gametophytes (embryo sacs)
Double fertilization and post fertilization changes leading to formation of seed, development of embryo, endosperm. Polyembryony and Apomixis. Role of embryology in taxonomy

M.Sc. Botany

(Semester-II)

MBOTCC-7: Physiology & Biochemistry (5 Credits)

Time: 3hrs Marks: 70

The question paper will consist of 7 questions divided into 3 sections.

Section A: Question No 1 will be compulsory comprising ten objective types questions (two from each Unit) each carrying two marks (10x2:20 marks).

Section B: Question No. 2 will also be compulsory and comprise five short answer types questions (one from each Unit) and students will have to attempt only four questions (4 x 5=20marks).

Section C: Five long answer types questions are to be set (one from each Unit) of which any three questions are to be answered (3 x 10=30 marks).

Unit- I

Osmotic relations; Transport phenomenon in plants: Transport of water and organic solutes, mechanism of xylem transport, mechanism of phloem transport, phloem loading and unloading

Unit- II

Energy transduction mechanism in plants: Photosynthesis: Difference between two pigment systems, Light reaction and dark reaction, water oxidizing complex; carbon fixation in C3 and'iaplants N2 fixation: Non-symbiotic and Symbiotic.

Unit-III

Plant growth and development: Growth hormones and growth regulators, mode of action of auxin, transport of auxin, physiological role of auxin. Gibberellin: Mode of action and physiological role
Cytokinin: Physiological role and mode of action

Unit-IV

Enzymology: Enzymes: structure and classification, cofactors, coenzymes, prosthetic groups, isoenzymes, allosteric enzymes, multienzymes, mechanism of enzyme action, properties of enzymei

Unit-V

Biochemical energeticl : Glycolysis, TCA Cycle, E.T.S. Oxidative phosphorylation. Photorespiration and its biological importance. Difference between oxidative phosphorylationand photo-phosphorylation.

M.Sc. Botany

(Semester-II)

MBOTCC-8: Plant tissue culture, ethanobotany, biodiversity & biometry (5 Credits)

Time: 3hrs **Marks: 70**

The question paper will consist of 7 questions divided into 3 sections.

Section A: Question No.1 will be compulsory comprising ten objective types questions (two from each Unit) each carrying two marks (10x2:20 marks).

Section B: Question No. 2 will also be compulsory and comprise five short answer types questions (one from each Unit) and students will have to attempt only four questions (4 x 5:20marks).

Section C: Five long answer types questions are to be set (one from each Unit) of which any three questions are to be answered (3 x 10:30 marks).

Unit I

Cell and Tissue culture: Laboratory equipments; General techniques of aseptic manipulation; Composition of culture media and its preparation Callus culture and suspension culture . Organ culture: In vitro culture of vegetative and reproductive. Plant protoplasts: Isolation, culture methods and plant regeneration Role of tissue culture in crop improvement

Unit II

Traditional ethnobotanical knowledge base: Traditional knowledge base of Indian ethnic and local communities and their practices. Ethnopharmacology, medical and paramedical use of plant by the local ethenic people. Ethnoecology: Use of local biodiversity by the local tribe / schedule caste

Unit III

Biodiversity concept: origin of the term, themes of biodiversity concept. Types of Biodiversity: Genetic, species and ecosystem diversity, distribution at global and national level. Assessment and inventory based on recommendation of IUCN, Biodiversity conventions and Biodiversity Act2002. Benefits of Biodiversity: Direct economic benefits to mankind, genetic resources, essential ecosystem services. Patterns of loss of Biodiversity: Red lists, Red Data Book and Green Book Red Data categories: Extinct, endangered, vulnerable and threatened species.

Unit- IV

Distinctions between preservation and conservation, Conservation potential index, Protocols for conservations, Traditional conservation practices *In situ* and *ex situ* conservation. Patenting, Intellectual property right, Biosafety protocols

Unit-V

Biometry : Distribution and measurement of variation, Mean, Median, Mode, Standard deviation, standard error, coefficient of variability, test of significance- t test, F- test (analysis of variants); Measurement of correlation coefficient, Application of chi-square test for testing hypothesis

MBOTCC-9: Practical 2
(Based on MBOTCC 5o 6,7,8 & 9) (5 Credits)

Time: 5 hrs **Marks: 70**

1. Preparation of culture media for growth of *Rhizobium, Azotobacter* and *Nostoc*.
2. Production microbial Biofertilizers: *Rhizobium, Azotobacter* and *Nostoc*.
3. Family description of some locally available Plants.
4. Anamalous secondary growth of some common plants (*Tinospora, Boerhaavia, Nyctanthes, Aristolochia, Amaranthus*).
5. Staining of Xylem and Phloem elements.
6. Study of stigma by squash method
7. Study of pollen germination
8. Mounting and study of embryo and endosperm.
9. Separation of chlorophyll pigment by paper chromatography.
10. Determination of water potential using plasmolytic method.
11. Estimation of protein by Lowry method.
12. Study of alpha-amylase in germinating seedlings.
13. Separation of amino acids by TLC.
15. Preparation of MS media for plant tissue culture.
14. Ex-plant culture and callus initiation.
15. Taxonomy and significance of some important medicinal plant.

M.Sc. Botany

(Semester-lll)

MBOTCC-I0: Cell Biology & Cytogenetics (5 Credits)

Time: 3hrs **Marks: 70**

The question paper will consist of 7 questions divided into 3 sections.

Section A: Question No.l will be compulsory comprising ten objective types questions (two from each Unit) each carrying two marks (10x2:20 marks).

Section B: Question No. 2 will also be compulsory and comprise five short answer types questions (one from each Unit) and students will have to attempt only four questions (4 x 5:20marks).

Section C: Five long answer types questions are to be set (one from each Unit) of which any three questions are to be answered (3 x l0:30 marks).

Unit I

Cell theory and organization of the cell (Prokaryotic and Eukaryotic). Ultrastructure chemical compos ition of the fol lowing: Cell wall, Plasma membrane, Cytoplasm and cytoplasmic organelles (origin, ultrastructure & function: Plastids, Mitochondria, Endoplasmic reticulum, ribosomes, Golgi complex, Lysosomes and Peroxisomes.

Unit-II

Nucleus: Nuclear membrane, nuclear pore, nucleolus and karyolymph. Cell division, Cell cycle and apoptosis, Control mechanism, cytokinesis and cell plate formation

Unit-III

Chromosome: Organization and special types. Mendelian genetics. Gene interaction. Sex determination

Unit-IV

Extranuclear inheritance. Chromosomal aberration, polyploidy-Upes and role in speciation. Mutations- Molecular mechanism, induction by physical and chemical mutagens

Unit- V

Population Genetics. Microscopy: Phase contrast microscopy, Electron microscopy (SEM and TEM), Fluorescence microscopy, Microdensitometry

M.Sc. Botany

(Semester-III)

MBOTCC-II: Molecular Biology (5 Credits)

Time: 3hrs **Marks: 70**

The question paper will consist of 7 questions divided into 3 sections.

Section A: Question No.1 will be compulsory comprising ten objective types questions (two from each Unit) each carrying two marks (10x2:20 marks).

Section B: Question No. 2 will also be compulsory and comprise five short answer types questions (one from each Unit) and students will have to attempt only four questions (4 x 5:20marks).

Section C: Five long answer types questions are to be set (one from each Unit) of which any three questions are to be answered (3 x 10:30 marks).

Unit I

Organization of DNA: Nucleic acids as hereditary material; Structure and forms of DNA and RNA, double helix, supercoiling of DNA

Unit II

DNA replication: DNA replication models; Mechanism of DNA replication. DNA damage and repair mechanism: Different types of DNA damage and repair mechanisms; Diseases caused due to impairment in repair mechanism

Unit III

Transcription: lmportance of DNA binding Proteins, RNA polymerase-types, structure and functions; Mechanism of Transcription in prokaryotes & Eukaryotes; Genetic code: Cracking of code; characteristics

Unit IV

Translation: Machinery and mechanism in prokaryotes and eukaryotes; role of t RNA & ribosome; post translational modification of proteins such as phosphorylation, adenylation, acylation and glycosylation

Unit-V

Regulation of gene expression: Prokaryotes- Positive and negative control, inducible and repressible operons, lac operon, trp operon. Eukaryotes- Regulation at DNA, transcription, translation and post translational level. Antisense technology: Molecular mechanism of antisense molecules, application of antisense technologies.

M.Sc. Botany

(Semester-III)

MBOTCC-II: Recombinant DNA Technology (5 Credits)

Time: 3hrs **Marks: 70**

The question paper will consist of 7 questions divided into 3 sections.

Section A: Question No.l will be compulsory comprising ten objective types questions (two from each Unit) each carrying two marks (10x2=20 marks).

Section B: Question No. 2 will also be compulsory and comprise five short answer types questions (one from each Unit) and students will have to attempt only four questions (4 x 5:20marks).

Section C: Five long answer types questions are to be set (one from each Unit) of which any three questions are to be answered (3 x 10:30 marks).

Unit I

rDNA technology: Techniques used in RDT: Polyacrylamide and agarose gel electrophoresis Blotting techniques: Southern, Northern and Western blouing Polymerase chain reaction and its applications, DNA sequencing: Various methods of DNA sequencing

Unit II

Core techniques and essential enzymes; Restriction enzymes-types and cleavage pattern; DNA ligase- types and ligation of DNA molecule *in vitro* Cloning vectors: Plasmids (natural, pBR322, Ti plasmid vectors), phages, cosmid, Shuttle vectors; Expression vector

Unit III

Passenger DNA: Different strategies used for isolation/synthesis of gene; Organ chemical synthesis of gene; Construction of genomic and cDNA libraries. Construction of rDNA: Different strategies for construction of rDNA (Use of restriction and enzymes, Linkers)

Unit IV

Selection strategies: Different methods for selection of clone (antibiotic resistant markers, colony hybridization, plaque hybridization, immuno screening). Methods of DNA transfer in suitable host: electroporation, electrofusion, microinjection and particle gun method, Expression of foreign gene

Unit V

Application of rDNA technology: In medicine, agriculture and environment protection
DNA finger printing: Methodology and its application. Safety of recombinant DNA technology: Restriction and regulation for the release of GMOs; Social and ethical issue

M.Sc. Botany

(Semester-III)

MBOTCC-I3: Plant Ecology and Environmental Biology (5 Credits)

Time: 3hrs **Marks: 70**

The question paper will consist of 7 questions divided into 3 sections.

Section A: Question No.l will be compulsory comprising ten objective types questions (two from each Unit) each carrying two marks (10x2:20 marks).

Section B: Question No. 2 will also be compulsory and comprise five short answer types questions (one from each Unit) and students will have to attempt only four questions (4 x 5:20marks).

Section C: Five long answer types questions are to be set (one from each Unit) of which any three questions are to be answered (3 x 10=30 marks).

Unit- I

Organism and population concept; Natality; Mortality; Density; Rate of population increase; r and k selection; Age and sex ratio; Aggregation Interactions among populations: Commensalism, Amensalism, Mutualism, protocooperation and Symbiosis, predation and parasitism, competition Intraspecifi c and interspecific. Plant adaptations

Unit- II

(i) Community Structure: Qualitative character : Physiognomy, phenology, Sociability, vitality, Raunkiaer'slife forms. Quantitative Character : Frequency, Density, Abundance, Cover and basal area. Synthetic character : Presence and constance, Fidelity, Importance value Index. Methods of studying plant community: euadrates, Transects, Bisect, Plotless method. Classification of communities: Physiognomic classification, Floristic classification, Dynamic system, Continum concept

(ii) Community dynamics: Concept of Succession, Nudation, Invasion, Competition and reaction, Stabilization and Climax, Xerosere and Hydrosere and their seral stage

Unit-III

Ecosystem: Abiotic and biotic components; Ecological pyramids; Structural organization of grassland, forest and aquatic ecosystem. Fcosystem energetic: l.aws of thermodynamics, Productivity, energy food chain and ecosystem budget; Biogeochemical cycles

Unit-IV

Environmental Pollutions: Air, Water, Soil, waste radioactive and noise pollution; Global warming; green house effect; 03 depletion; Climate change

Unit-V

Environmental Awareness: Man and Biosphere (MAB); International Union for Conservation of Nature and Natural Resources (IUCN); United Nations Environment Programme (tINEp); World Environmental Day; Wildlife Preservation Act(1972);Indian Forest Conservation Act (1989)

MBOTCC-I4: Practical3 (Based on MBOTCC 5,6,7, g & 9) (5 Credits)

Time: 5 hrs **Marks: 70**

1. Principle and use of different modern instruments used in Botany.
2. Cytological techniques: Preparation of cytological stains, fixation of sample etc.
3. Mitotic slide preparation of common plant.
4. Meiotic slide preparation of common plant.
5. Karyotype analysis.
6. Calculation of chiasma frequency.
7. Isolation of antibiotic resistant mutant by auxanography technique.
8. Isolation of genomic DNA from cauliflower.
9. Spectrophotometric estimation of DNA by diphenyl method.
10. Separation of DNA by agarose gel electrophoresis.
11. Demonstration of amplification of DNA using pCR.
12. Study of local vegetation by quadrate method.
13. Study of ecological adaptations (Morphological and anatomical) in plants.
14. Water analysis for pollution studies (Dissolved Oxygen, BOD, and Dissolved Carbon dioxide. Chloride, Alkalinitv etc.

M.Sc. Botany

(Semester-IV)

Option I

It consist of Core Elective papers

MBOTEC-I: Cytogenetics and Crop improvement (5 Credits)

MBOTEC-2: Practical based on MBOTEC-I (5 Credits)

MBOTEC-I: Applied Microbiology and Plant Pathology (5 Credits)

MBOTEC-2: Practical based on MBOTEC-I (5 Credits)

Or any other Elective Core papers decided by BOCS and duly approved by competent bodies of the University.

Option II

MBOTEC-I: Any theory paper of Core Elective

MBOTEC-2: Project dissertation and Viva-voce

Option III

MBOTEC-I and MBOTEC-2:.Combined together and act as Project disseriation and Viva-voce carrying 200 marks (10 Credits).

M.Sc. Botany

(Semester-IV)

MBOTBC-I: Cytogenetics and Crop improvement (5 Credits)

Time: 3hrs **Marks: 70**

The question paper will consist of 7 questions divided into 3 sections.

Section A: Question No.l will be compulsory comprising ten objective types questions (two from each Unit) each carrying two marks (I 0x2:20 marks).

Section B: Question No. 2 will also be compulsory and comprise five short answer types questions (one from each Unit) and students will have to attempt only four questions (4 x 5:20marks).

Section C: Five long answer types questions are to be set (one from each Unit) of which any three questions are to be answered (3 x l0:30 marks).

Unit I

Haploidy- Origin, production, cytological behaviour and genetic uses. Aneuploidy and polyploidy- Origin, classification, production, cytological behaviour and genetic uses; Role of polyploidy in evolution and speciation; Evolution of karyotypes. Chromosome banding pattern: Techniques, functional differentiation of chromosome segments, their chemical nature, significance and effect

Unit II

Mutations: Spontaneous and induced; physical and chemical mutagens- classification, mode of action; molecular basis of gene mutations; site directed mutagenesis; role of mutations in crop improvement Cytoplasmic inheritance and maternal effect

Transposons: Structure and types of transposons (Prokaryotic and Eukaryotic); Mechanism of transposition (replicative and non-replicative); Retroposons ; Application of transposon

Unit- III

Role Cytogenetics in crop improvement. Epigenetics: lntroduction; histone code; base modification; paramutations in maize; Epigenetics and Lamarckism; Epigenome and epigenomics.

Unit IV

Role Cytogenetics in crop improvement. Genetic basis of evolution and speciation

Incompatibility Centres of origin of cultivated crops

Unit V

A Brief account of classical methods of plant breeding. Modern techniques of plant breeding: Hybrids vs cybrids, protoplast fusion and somatic hybridization (parasexual hybridization techniques) and a brief idea of Terminator gene technology. Heterosis and heterosis breeding. Breeding for disease and drought resistance

MBOTEC-2: Practical based on MBOTEC-I (Cytogenetics and Crop improvement) (5 Credits)

M.Sc. Botany

(Semester-IV)

MBOTEC-I: Applied Microbiology and plant pathology (5 credits)

Time: 3hrs **Marks: 70**

The question paper will consist of 7 questions divided into 3 sections.
Section A: Question No.l will be compulsory comprising ten objective types questions (two from each Unit) each carrying two marks (10x2:20 marks).

Section B: Question No. 2 will also be compulsory and comprise five short answer types questions (one from each Unit) and students will have to attempt only four questions (4 x 5:20marks).

Section C: Five long answer types questions are to be set (one from each Unit) of which any three questions are to be answered (3 x 10:30 marks).

Unit I
Fermentation technology: Scope and prospects. Microbial Metabolites: Primary and secondary metabolites; Production of organic acids (citric acid), amino acid (Glutamic acid) and Vitamin (Vitamin B12). Production of antibiotics (Streptomycin). Enzymes production and their commercial applications: Amylases, proteases Renin

Unit II
Biochemical activity of microorganisms in milk. Fermented dairy products: yogurt and cheeses
Microorganisms as food; Single cell proteins (SCP), Edible mushroom (Button and Oyster), Fermented beverages: Production ofwine and beer

Unit III
Treatment of solid wastes: Composting & Land filling. Wastewater treatment methods: Oxidation pond, Trickling filter, Activated sludge methods; Anaerobic treatment of wastewater. Waste water treatments by plants. Bioremediation and biogas production

Unit IV
History, classification and importance of plant pathology Chemical and biological management of plant disease control. Integrated pest management (lPM). Biopesticides: Bacterial, viral and fungal biopesticides and their and applications

Unit V
Selected plant diseases with special reference to symptoms, etiology and disease management Cereals: blast of rice, Karnal bunt of wheat. Fruits & Vegetables: Downy mildew of cucurbits, Bacterial spots of tomato, downy mildew of grapes. Pulses: Wilt of arhar, powdery mildew of pea
Oil seeds: Rust of linseed. Fibre crop: Wilt of cotton. Spices & condiments: Stem galls of coriander, leaf spot of turmeric and leaf curl of chilli. Sugarcane: Whip smut ofsugarcane, grassy shoot disease of sugarcane,Tea, Coffee & Tobacco: Blister blight of tea, leaf rust of coffee & leaf blunt of tobacco

MBOTEC-2: Practical based on MBOTEC-I (Applied Microbiology and Plant pathology)
(5 Credits)