DEPARTMENT OF BOTANY

SYLLABI AND SCHEME OF EXAMINATIONS FOR DISCIPLINE SPECIFIC COURSES OF

Bachelor of Science (Botany as Single Major) Program with Hons. in Botany under NEP-2020 (w. e. f. July, 2024-25)

Under multiple entry, exit, internship and Learning Outcomes Based Curriculum and Credit Framework for Bachelor of Science (Botany as Single Major) Program

MAHARSHI DAYANAND UNIVERSITY ROHTAK (HARYANA)

DEPARTMENT OF BOTANY

Name of the Program: **B.Sc. (Botany as Single Major)**

Duration of the Program: **Three/Four Years**

Total Credits for the Program: **184**

Program Specific outcomes

PSO 1: Identify and classify the plants, their evolution and diversity

POS 2: Acquisition about structure and life cycle of plants

POS 3: Capability to understand the plant morphology, anatomy, development and reproductive biology, physiology, biochemistry, biotechnology and molecular biology

POS 4: Collection and preservation of plants

PSO 5: Extensive care for rare, endangered and threatened plants listed in Red Data Book

PSO 6: Skill development for challenging area of Plant Biology

POS 7: Global importance for the role of plants in climate change, pollution control, sustainable goal, green technology etc.

Credit matrix for Ist Year of B.Sc. (Botany as Single Major) Program

Semester	Discipline-Specific Courses (DSC)	Minor (MIC)/ Vocational (VOC)	Multidisciplinary courses (MDC)	Ability Enhancement courses (AEC)	Skill Enhancement Courses (SEC)	Value added Course (VAC)	Total Credits
I	8	4	3	2	3	2	22
II	8	4	3	2	3	2	22

*Students exiting the programme after second semester and securing 48 credits including 4 credits of summer internship (*24BOTS402IN1*) will be awarded UG Certificate in the relevant Discipline/ Subject*

Credit matrix for 2nd Year of B.Sc. (Botany as Single Major) Program

Semester	Discipline-Specific Courses (DSC)	Minor (MIC)/ Vocational (VOC)	Multidisciplinary courses (MDC)	Ability Enhancement courses (AEC)	Skill Enhancement Courses (SEC)	Value added Course (VAC)	Total Credits
III	8	4	3	2	3	2	22
IV	16	4	-	2	--	2	24

*Students exiting the programme after fourth semester and securing 94 credits including 4 credits of summer internship (*25BOTS404IN1*) will be awarded UG Diploma in the relevant Discipline/Subject.*

Credit matrix for 3rd Year of B.Sc. (Botany as Single Major) Program

Semester	Discipline-Specific Courses (DSC)	Minor (MIC)/ Vocational (VOC)	Multidisciplinary courses (MDC)	Ability Enhancement courses (AEC)	Skill Enhancement Courses (SEC)	Value added Course (VAC)	Total Credits
V	16	4	-	--	4 (internship)	--	24
VI	16	4	-	--	2	--	22

Students will be awarded 3-year UG Degree in the relevant Discipline/Subject upon securing 136 credits.

Credit matrix for 4th Year of B.Sc. (Botany Hons.) Program* (Option 1- Only course work)

Semester	Discipline-Specific Courses (DSC)	Minor (MIC)/ Vocational (VOC)	Multidisciplinary courses (MDC)	Ability Enhancement courses (AEC)	Skill Enhancement Courses (SEC)	Value added Course (VAC)	Total Credits
VII	20	4	-	--	--	--	24
VIII	20	4	-	--	--	--	24

Credit matrix for 4th Year of B.Sc. (Botany Hons.) Program (Option 2*- Course work with Research)

Semester	Discipline-Specific Courses (DSC)	Minor (MIC)/ Vocational (VOC)	Multidisciplinary courses (MDC)	Ability Enhancement courses (AEC)	Skill Enhancement Courses (SEC)	Value added Course (VAC)	Total Credits
VII	20	4	-	--	--	--	24
VIII	08	4	-	--	12 (RP/ Dissertation)	--	24

Total Credits for 4yr UG (Hons) program are 184

***Note:** Students entering 4th year Graduate Program after a 3-year UG program can choose to do:

i) Only course work in the 7th and 8th semester **(Option -1) OR**

ii) Course work in the 7th and research in the 8th semester **(Option -2)**

- Four credits of internship earned by a student during summer internship after 2nd *(*25BOTS403IN1*)* semester or 4th *(*26BOTS405IN1*)* semester will be counted in 5th semester of a student who pursue 3 year UG Programmes without taking exit option.
- Skill Enhancement courses for imparting skills related to major/minor
- *This framework is subject to modification as per UGC guidelines at the University level. The universities may decide to offer the Honors degree Programmes subject to the fulfilment of credit point table*

INSTRUCTIONS FOR THE STUDENTS

Course Types

Discipline Specific Course (DSC)/Major Course
Discipline specific/Major course is the discipline or subject of main focus in which the degree will be awarded. Students should secure the prescribed number of credits (at least 50% of total credits) through Discipline Specific Course/Major Course in the major discipline.

Minor Course (MIC)
Minor discipline is the discipline that helps a student to gain a broader understanding beyond the major discipline. For example, if a student pursuing Economics as major course may choose Statistics as minor course.

Vocational Course (VOC)
Vocational Course assists student in developing workforce-relevant skills and enhance the employability of student.

Multidisciplinary Course (MDC)
A Multidisciplinary Course is an option to explore disciplines of interest beyond the choices of learners made in their major and minor disciplines.

Ability Enhancement Course (AEC)
Ability Enhancement Course aims to achieve competency in language and communication skills
.

Skill Enhancement Course (SEC)
Skill Enhancement Course aims to promote skills pertaining to a particular field of study, impart practical skills, hands-on training, soft skills, etc., in order to enhance the student's employability.

Internship
Internship is a course to develop a professional ability through an appropriate learning. The duration of Internship is of 120 hours during summer vacation.

Research Project
Research Project is a course involving applications of knowledge in exploring, analyzing and solving real-life situations/problems.

Dissertation
Dissertation is a long piece of academic writing based on original research.

Value Added Course (VAC)
Value Added Course aims to add the knowledge of learner beyond academic disciplines.

Semester/Academic Year
A semester comprises 90 working days and an academic year is divided into two semesters.

Academic Bank Account
Academic Bank Account is an individual account with the Academic Bank of Credits opened and operated by a student, to which all academic credits earned by the Student from course(s) of study are deposited, recognized, maintained, accumulated, transferred, validated or redeemed for the purposes of the award of degree/diploma/certificates etc. by an awarding institution.

Multiple Entry and Exit Points
These are stages where the students may have options for entry and exit as per UGC Guidelines for Multiple Entry and Exit in Academic Programs.

Credit Point: It is the product of the grade point and the number of credits for a course.

Grade Point: It is a numerical weight allotted to each letter grade on a 10-point scale.

Letter Grade: It is an index of the performance of students in a said course. Grades are denoted by letters O, A+, A, B+, B, C, P and F.

Semester Grade Point Average (SGPA): The SGPA is the ratio of total credit points secured by a student in various courses registered in a semester and the total course credits taken during that semester. It shall be expressed up to two decimal places.

Cumulative Grade Point Average (CGPA): The CGPA is the ratio of total credit points secured by a student in various courses in all semesters and the sum of the total credits of all courses in all the semesters. It is expressed up to two decimal place

SCHEME OF EXAMINATIONS FOR DISCIPLINE SPECIFIC COURSES FOR B. Sc. (Botany as Single Major) WITH HONS. IN BOTANY

Discipline Specific Courses/ Major Course			Credits Distribution			Total Credits	Workload			Total Workload	Marks				
	Nomenclature of Course	Course Code	L	T	P		L	T	P		Theory		Practical		Total Marks
											Internal	External	Internal	External	
Semester I (Session 2024-25)															
DSC - A1 @ 4 credits	Diversity of Microbes	24BOTS401DS01	2	0	2	04	2	0	4	06	15	35	15	35	100
DSC – A2 @ 4 credits	Plant Cell Biology	24BOTS401DS02	2	0	2	04	2	0	4	06	15	35	15	35	100
Semester II (Session 2024-25)															
DSC – A3 @ 4 credits	Mycology and Phytopathology	24BOTS402DS01	2	0	2	04	2	0	4	06	15	35	15	35	100
DSC – A4 @ 4 credits	Plant Genetics	24BOTS402DS02	2	0	2	04	2	0	4	06	15	35	15	35	100
Semester III (Session 2025-26)															
DSC – A5 @ 4 credits	Diversity of Bryophytes	25BOTS403DS01	2	0	2	04	2	0	4	06	15	35	15	35	100
DSC – A6 @ 4 credits	Plant Molecular Biology	25BOTS403DS02	2	0	2	04	2	0	4	06	15	35	15	35	100
Semester IV (Session 2025-26)															
DSC – A7 @ 4 credits	Diversity of Pteridophytes	25BOTS404DS01	2	0	2	04	2	0	4	06	15	35	15	35	100
DSC – A8 @ 4 credits	Palaeobotany & Diversity of Gymnosperms	25BOTS404DS02	2	0	2	04	2	0	4	06	15	35	15	35	100
DSC – A9 @ 4 credits	Plant Ecology	25BOTS404DS03	2	0	2	04	2	0	4	06	15	35	15	35	100

DSC – A10 @ 4 credits	Phytogeography and Biodiversity Conservation	25BOTS404DS04	2	0	2	04	2	0	4	06	15	35	15	35	100
Semester V (Session 2026-27)															
DSC – A11 @ 4 credits	Plant Morphology and Anatomy	26BOTS405DS01	2	0	2	04	2	0	4	06	15	35	15	35	100
DSC – A12 @ 4 credits	Plant Embryology	26BOTS405DS02	2	0	2	04	2	0	4	06	15	35	15	35	100
DSC – A13 @ 4 credits	Plant Taxonomy	26BOTS405DS03	2	0	2	04	2	0	4	06	15	35	15	35	100
DSC – A14 @ 4 credits	Plant Resource Utilization	26BOTS405DS04	2	0	2	04	2	0	4	06	15	35	15	35	100
Semester VI (Session 2026-27)															
DSC – A15 @ 4 credits	Plant Physiology and Biochemistry	26BOTS406DS01	2	0	2	04	2	0	4	06	15	35	15	35	100
DSC – A16 @ 4 credits	Biostatistics and Computer Applications	26BOTS406DS02	2	0	2	04	2	0	4	06	15	35	15	35	100
DSC – A17 @ 4 credits	Plant Metabolism & Genetic Engineering	26BOTS406DS03	2	0	2	04	2	0	4	06	15	35	15	35	100
DSC – A18 @ 4 credits	Principles of Plant Breeding	26BOTS406DS04	2	0	2	04	2	0	4	06	15	35	15	35	100
Semester VII (Session 2027-28) 4 year UG Botany Hons. Program															
DSC – H1 @ 4 credits	Microbial Diversity	24BOT201DS01	2	0	2	04	2	0	4	06	15	35	15	35	100
DSC – H2 @ 4 credits	Advances in Cryptogrammic Botany	24BOT201DS02	2	0	2	04	2	0	4	06	15	35	15	35	100
DSC – H3 @ 4 credits	Plant Cell & Molecular Biology	24BOT201DS003	2	0	2	04	2	0	4	06	15	35	15	35	100
DSC – H4 @ 4 credits	Anatomy of Angiosperms	24BOT201DS04	2	0	2	04	2	0	4	06	15	35	15	35	100
DSC – H5 @ 4 credits	Plant Tissue Culture &	24BOT201DS05	2	0	2	04	2	0	4	06	15	35	15	35	100

	Resource Utilization														
Students should select any one option (either I or II) for SEM –VIII of UG programme															
Semester VIII (Session 2027-28)															
4 year UG Botany Hons. Program Option 1 (only Course Work)-Option I															
DSC – H6 @ 4 credits	**Plant Biochemistry & Metabolism**	**24BOT202DS01**	**2**	**0**	**2**	**04**	**2**	**0**	**4**	**06**	**15**	**35**	**15**	**35**	**100**
DSC – H7 @ 4 credits	**Taxonomy of Angiosperms**	**24BOT202DS02**	**2**	**0**	**2**	**04**	**2**	**0**	**4**	**06**	**15**	**35**	**15**	**35**	**100**
DSC – H8 @ 4 credits	**Plant Biotechnology**	**24BOT202DS03**	**2**	**0**	**2**	**04**	**2**	**0**	**4**	**06**	**15**	**35**	**15**	**35**	**100**
DSC – H9 @ 4 credits	**Economic Botany**	**24BOT202DS04**	**2**	**0**	**2**	**04**	**2**	**0**	**4**	**06**	**15**	**35**	**15**	**35**	**100**
DSC – H10 @ 4 credits	**Techniques in Plant Sciences**	**24BOT202DS05**	**2**	**0**	**2**	**04**	**2**	**0**	**4**	**06**	**15**	**35**	**15**	**35**	**100**
Semester VIII (Session 2027-28)															
4 year UG Botany Hons. Program Option 1 (Course Work with Research)- Option II															
DSC – H6 @ 4 credits	**Plant Biochemistry & Metabolism**	**24BOT202DS01**	**2**	**0**	**2**	**04**	**2**	**0**	**4**	**06**	**15**	**35**	**15**	**35**	**100**
DSC – H7 @ 4 credits	**Taxonomy of Angiosperms**	**24BOT202DS02**	**2**	**0**	**2**	**04**	**2**	**0**	**4**	**06**	**15**	**35**	**15**	**35**	**100**
DSC – H8 @ 4 credits	**Research Project/ Dissertation**	**27BOT408PD01**	**0**	**0**	**12**	**12**	**0**	**0**	**24**	**24**					**300**

L: Lecture; T: Tutorial; P: Practical

Note: The Syllabi and Scheme of Examinations (SOE) for Discipline Specific Courses/Major Courses for UG Semester 7 and Semester 8 will be same as applicable for Syllabi and S.O.E. for Post Graduate semester 1 and semester 2, respectively.

SYLLABI FOR DISCIPLINE SPECIFIC COURSES FOR BACHELOR OF SCIENCE (Botany as Single Major) WITH HONS. IN BOTANY

Semester –I (Session: 2024-25)

Name of Program	**Bachelor of Science (Botany)**	**Program Code**	**USBT4**
Paper No.	**Paper 1 (Theory)**	**Nomenclature**	**Diversity of Microbes**
Name of the Course	**Discipline Specific Course (DSC-A1)**	**Course Code**	**24BOTS401DS01**
Hours per Week	**02**	**Maximum Marks**	**50**
Credits	**02**	**Internal Marks**	**15**
Duration of Examinations	**03 hours**	**External Marks**	**35**

Note:
Examiner will set nine (09) questions and the candidates will be required to attempt five questions in all. Question number one (01) will be compulsory containing short answer type questions covering the entire syllabus from all units. Further, examiner will set two (02) questions from each unit and the candidates will be required to attempt one question from each Unit. All questions will carry equal marks.

Course Objectives

- To study the salient feature, life cycle and economic importance of bacteria, algae and virus and to train the students for collection and preservation of microbes and algae.

Course Learning Outcomes (CLO)

After completion of this course, the students will be acquainted themselves with the following concepts of Botany:

CLO 1: Ultra structure, reproduction and economic importance of bacteria

CLO 2: Life-cycle of Nostoc, Chlamydomonas, Volvox, Oedogonium, Coleochaete, Chara, Vaucheria, Ectocarpus, Fucus., Polysiphonia

CLO 3: Identification, classification, reproduction and economic importance of various Algae

CLO 4: Biological characteristics; classification; replication of Virus

CLO 5: General concepts regarding microbial growth , metabolism and nutrition

Unit 1

Introduction to microbial world: Microbial nutrition, growth and metabolism. Economic importance of viruses with reference to vaccine production, role in research, medicine and diagnostics, as causal organisms of plant diseases. Economic importance of bacteria with reference to their role in agriculture and industry (fermentation and medicine).

Viruses: Discovery, physiochemical and biological characteristics; classification (Baltimore), general structure with special reference to viroids and prions; replication (general account), DNA virus (T-phage), lytic and lysogenic cycle; RNA virus (TMV).

Bacteria: Discovery, general characteristics; Types-archaebacteria, eubacteria, wall-less forms (mycoplasma and spheroplasts); Cell structure; Nutritional types; Reproduction-vegetative, asexual and recombination (conjugation, transformation and transduction).

Unit 2

Algae: General characteristics; Ecology and distribution; range of thallus organization; Cell structure and components; cell wall, pigment system, reserve food (of only groups represented in the syllabus), flagella; methods of reproduction; Classification; criteria, system of Fritsch, and evolutionary classification of Lee (only upto groups); Significant contributions of important phycologists (F.E. Fritsch, G.M. Smith, R.N. Singh, T.V. Desikachary, H.D. Kumar, M.O.P. Iyengar). Role of algae in the environment, agriculture, biotechnology and industry.

Unit 3

Cyanophyta and Xanthophyta: Ecology and occurrence; Range of thallus organization; Cell Cyanophyta, Chlorophyta, Xanthophyta and Bacillariophyta: Cyanophyta and Xanthophyta: Ecology and occurrence; Range of thallus organization; Cell structure; Reproduction, Morphology and life-cycle of Nostoc, Oscillatoria and Vaucheria. Evolutionary, significance of Prochloron. Chlorophyta and Bacillariophyta: General characteristics; Occurrence; Range of thallus organization; Cell structure Reproduction. Morphology and life-cycles of Volvox Oedogonium, Chara and Pinnularia.

Unit 4

Phaeophyta and Rhodophyta: Characteristics; Occurrence; Range of thallus organization; Cell structure; Reproduction. Morphology and life-cycles of Ectocarpus, Dictyota, Fucus, Batrachospermum and Polysiphonia.

Semester –I (Session: 2024-25)

Name of Program	Bachelor of Science (Botany)	Program Code	USBT4
Paper No.	Paper 1 (Practical)	Nomenclature	Diversity of Microbes
Name of the Course	Discipline Specific Course (DSC-A1)	Course Code	24BOTS401DS01
Hours per Week	04	Maximum Marks	50
Credits	02	Internal marks	15
Time of Examinations	03	External marks	35

Note

Course Objectives

To study the salient feature, life cycle and economic importance of bacteria, algae and virus and to train the students for collection and preservation of microbes and algae.

Course Learning Outcomes (CLO)

After completion of this course, the students must be able to acquaint themselves with the following concepts of Botany:

CLO 1: Ultra structure, reproduction and economic importance of bacteria

CLO 2: Life-cycle of Nostoc, Chlamydomonas, Volvox, Oedogonium, Coleochaete, Chara, Vaucheria, Ectocarpus, Fucus., Polysiphonia

CLO 3: Identification, classification, reproduction and economic importance of various Algae

CLO 4: Biological characteristics; classification; replication of Virus

CLO 5: General concepts regarding microbial growth , metabolism and nutrition

List of Practical:

1. Electron micrographs/Models of viruses – T-Phage and TMV, Line drawings/
2. Photographs of Lytic and Lysogenic Cycle.
3. Types of Bacteria to be observed from temporary/permanent slides/photographs.
4. Electron micrographs of bacteria, binary fission, endospore, conjugation, root Nodule and Gram staining.
5. Endospore staining with malachite green using the (endospores taken from soil bacteria).
6. Study of vegetative and reproductive structures of Nostoc, Oscillatoria, Volvox,
7. Oedogonium, Chara, Vaucheria, Ectocarpus, Fucus, Batrachospermum, Polysiphonia and Procholoron through electron micrographs, temporary preparations and permanent slides.

8. Study of local algal flora through excursion and field visits.

Pattern of Examination

1. Identify and comment on the given micrographs/ models/ line drawings/ photographs of viruses and bacteria. (4)
2. Identify, classify and write short morphological notes giving well labelled relevant diagrams on the given two specimens A & B. (6)
3. Preparation of media (PDA,YPSS Agar medium) for aeroflora/ Gram Staining technique/Endospore staining with malachite green (4)
4. Identify giving two important characters of identification of the given spots 1, 2, 3. (6)
5. To identify and comment upon the given plant diseases. (3)
6. Field visit and collection records (4)
7. Practical records (4)
8. Viva-voce (4)

References/Suggested readings:

1. Kumar, H.D. (1999). Introductory Phycology. Affiliated East-West Press, Delhi.
2. Lee, R.E. (2008). Phycology. Cambridge University Press, Cambridge. 4th edition.
3. Pelczar, M.J. (2001) Microbiology. 5th edition. Tata McGraw-Hill Co, New Delhi.
4. South, G.R. and Whittick, A. (1987). Introduction to Phycology. Blackwell Scientific Publications, Oxford.
5. Campbell, N.A., Reece, J.B., Urry, L.A., Cain, M.L., Wasserman, S.A. Minorsky, P. V. and Jackson, R.B. (2008). Biology. Pearson Benjamin Cummings, USA. 8th edition.
6. Van Den Hock, C., Mann, D.G. and Johns, H.M. (1995). An Introduction to Phycology, Cambridge University Press, Cambridge.
7. Wiley, J. M, Sherwood, L.M. and Woolverton, C.J. (2013). Prescott's Microbiology. 9th Edition. McGraw Hill International.

Semester –I (Session: 2024-25)

Name of Program	**Bachelor of Science (Botany)**	**Program Code**	**USBT4**
Paper No.	**Paper 2 (Theory)**	**Nomenclature**	**Plant Cell Biology**
Name of the Course	**Discipline Specific Course (DSC-A2)**	**Course Code**	**24BOTS401DS02**
Hours per Week	**02**	**Maximum Marks**	**50**
Credits	**02**	**Internal marks**	**15**
Time of Examinations	**03**	**External marks**	**35**

Note:
Examiner will set nine (09) questions and the candidates will be required to attempt five questions in all. Question number one (01) will be compulsory containing short answer type questions covering the entire syllabus from all units. Further, examiner will set two (02) questions from each unit and the candidates will be required to attempt one question from each Unit. All questions will carry equal marks.

Course Objectives:
To familiarize the students with structure and functions of plant cell, different prokaryotic and eukaryotic cell

Course Learning Outcomes (CLO):

CLO 1: Learn the plant cell structure, function

CLO 2: Study the transport mechanism

CLO 3: Familiarise about the cell division

CLO 4: Know the various spectroscopic techniques

Unit 1

Cell and Cell wall: Ultrastructure of prokaryotic & eukaryotic cells; structure, organisation & function of plant cell wall. Membrane structure and function -Structure of model membrane, lipid bilayer and membrane protein diffusion, osmosis, ion channels, active transport, membrane pumps, mechanism of sorting and regulation of intracellular transport, electrical properties of membranes

Unit 2

Cell Organelles: Structural organization and function of intracellular organelles: nucleus, mitochondria, Golgi bodies, lysosomes, endoplasmic reticulum, peroxisomes, plastids, vacuoles, chloroplast; structure & function of cytoskeleton and its role in motility

Unit 3

Cell division and Cell Cycle: Mitosis and meiosis, steps in cell cycle, regulation and control of cell cycle); mechanism of programmed cell death

Cellular communication: Communication between plant cells, including cell-to-cell signaling via plasmodesmata; signal perception and transduction; cell adhesion and roles of different adhesion molecules; gap junctions; extracellular matrix; genetic regulation of signaling pathways**:** transcriptional and post-transcriptional regulation of genes involved in plant signaling pathways

Unit 4

Microscopy: Principles of Light microscopy; Phase contrast microscopy; Confocal microscopy; Electron microscopy (EM) - Scanning EM (SEM) and Transmission EM (TEM); Fluorescence microscopy

Flow cytometry- Flurochromes, fluorescent probe and working principle; Spectrophotometry; Mass spectrometry; X-ray diffraction analysis. Separation: Sub-cellular fractionation- differential and density gradient centrifugation; Chromatography- paper, thin-layer, gel-filtration, ion-exchange, affinity and High Performance Liquid Chromatography (HPLC)

Semester –I (Session: 2024-25)

Name of Program	**Bachelor of Science (Botany)**	**Program Code**	**USBT4**
Paper No.	**Paper 2 (Practical)**	**Nomenclature**	**Plant Cell Biology**
Name of the Course	**Discipline Specific Course (DSC-A2)**	**Course Code**	**24BOTS401DS02**
Hours per Week	**04**	**Maximum Marks**	**50**
Credits	**02**	**Internal marks**	**15**
Time of Examinations	**03**	**External marks**	**35**

Note:
Students should draw diagram of microscopes
Students should draw different stages of mitosis and meiosis
Students should study techniques of chromatography for separation of components of a mixture

Course Objectives:
To familiarize the students with structure and functions of plant cell, different prokaryotic and eukaryotic cell

Course Learning Outcomes (CLO):

CLO 1: Learn the plant cell structure, function

CLO 2: Study the transport mechanism

CLO 3: Familiarise about the cell division

CLO 4: Know the various spectroscopic techniques

List of Practical

1. Study of cell and its organelles with the help of electron micrographs.
2. Study the effect of organic solvent and temperature on membrane permeability.
3. Prepare smear/squash to study different stages of mitosis and meiosis
4. Study techniques of Microscopy and flow cytometry

Pattern of examination

1. Prepare the root smear and find out two different stages of Mitosis. Identify and show it to the

examiners. Also give characters of identification. (6) 2. Identify the two stages of Meiosis from given permanent slide and write brief notes. (4) 3. Identify and comment on the specimen A, B & C (Chart/ Model /Photograph from Cell organelles, Microscopy and Flow cytometry). (9) 1. Separate out the components of given mixture using chromatography techniques (as per syllabus) (4) 2. Comment on the given micrographs/ models/ photographs of cell organelles (4) 3. Practical records (4) 4. Viva-voce (4)
References/ Suggested Readings 1. De Robertis, EDP, Dc Robertis, E.M.F., Cell Biology and Molecular Biology, Eighth Edition. W.B. Saunders Co., Philadelphia, 1995. 2. Powar, C.B., Cell Biology, Himalaya Publishing House, Bombay, 1999. 3. Alberts, B Bray, D., Lewis, J., Raff, M., Roberts, K., Watson, J.D., Molecular Biology of the Cell, Gerland Publ. Inc., New York, 1998. 4. Lodish H, Berk A, Kaiser, CA, Krieger M, Scott MP Bretscher A Ploegh H and Matsudaira P (2008) Molecular Cell Biology (6th Ed), W.H. Freeman and Company, New York, USA.

Semester –II (Session: 2024-25)

Name of Program	**Bachelor of Science (Botany)**	**Program Code**	**USBT4**
Paper No.	**Paper 1 (Theory)**	**Nomenclature**	**Mycology and Phytopathology**
Name of the Course	**Discipline Specific Course (DSC A3)**	**Course Code**	**24BOTS402DS01**
Hours per Week	**02**	**Maximum Marks**	**50**
Credits	**02**	**Internal marks**	**15**
Time of Examinations	**03**	**External marks**	**35**

Note:
Examiner will set nine (09) questions and the candidates will be required to attempt five questions in all. Question number one (01) will be compulsory containing short answer type questions covering the entire syllabus from all units. Further, examiner will set two (02) questions from each unit and the candidates will be required to attempt one question from each Unit. All questions will carry equal marks.

Course Objectives:
Objectives: To provide knowledge about various classes of fungi and their significance, fungal diseases and their effects on plants.

Course Learning Outcomes (CLO):

CLO 1: Understand the fungus structure classification life cycle

CLO 2:Know about the economic importance of fungus

CLO 3: Understand the structure, classification life cycle and importance of lichen

CLO 4: Aware about the host-pathogen interaction, disease and their prevention

Unit 1

General characteristics; organization of thallus; Cell wall composition; nutrition and reproduction; Classification upto classes (Ainsworth and Bysby 1983); Concept of homothallism and heterothallism, heterokaryosis; parasexuality; alternation of generations; Economic importance of fungi.

Mastigomycotina: General characteristics; Ecology; Life cycle and classification with reference to Synchytrium, Phytophthora and Albugo.

Zygomycotina: General characteristics; Ecology; Life cycle and classification with reference to Rhizopus.

Unit 2

Ascomycotina: General characteristics (asexual and sexual fruiting bodies); Ecology; Life cycle and classification with reference to Saccharomyces, Aspergillus, Penicillium and Neurospora.

Basidiomycotina: General characteristics; Ecology; Life cycle and Classification with reference to black stem rust on wheat Puccinia. Agaricus; Bioluminescence, Fairy Rings.

Deuteromycotina: General characteristics and Life cycle with reference to Alternaria and Colletotrichum

Unit 3

Lichen: Occurrence; Classification; General characteristics; Growth forms and range of thallus organization; Reproduction; Nature of associations of algal and fungal partners;

Mycorrhiza- Ectomycorrhiza, Endomycorrhiza and their significance.

Applied Mycology: Role of fungi in biotechnology; Application of fungi in food industry (Flavour & texture, Fermentation, Baking, Organic acids, Enzymes, Mycoproteins); Secondary metabolites (Pharmaceutical preparations); Agriculture (Biofertilizers); Mycotoxins; Biological control (Mycofungicides, Mycoherbicides, Mycoinsecticides, Myconematicides); Medical mycology.

Unit 4

Phytopathology: Terms and concepts; General symptoms; Geographical distribution of diseases; Etiology; Symptomology; Host-Pathogen relationships; Disease cycle and environmental relation; prevention and control of plant diseases, and role of quarantine.

Bacterial diseases – Citrus canker and angular leaf spot of cotton.

Viral diseases – Tobacco Mosaic viruses and vein clearing.

Fungal diseases – Early blight of potato, Black stem rust of wheat, White rust of crucifers.

Semester –II (Session: 2024-25)

Name of Program	**Bachelor of Science (Botany)**	**Program Code**	**USBT4**
Paper No.	**Paper 1 (Practical)**	**Nomenclature**	**Mycology and Phytopathology**
Name of the Course	**Discipline Specific Course (DSC A3)**	**Course Code**	**24BOTS402DS01**
Hours per Week	**04**	**Maximum Marks**	**50**
Credits	**02**	**Internal marks**	**15**
Time of Examinations	**03**	**External marks**	**35**
Note:			

Course Objectives:
Objectives: To provide knowledge about various classes of fungi and their significance, fungal diseases and their effects on plants.

Course Learning Outcomes (CLO):

CLO 1: Understand the fungus structure classification life cycle

CLO 2: Know about the economic importance of fungus

CLO 3: Understand the structure, classification life cycle and importance of lichen

CLO 4: Aware about the host-pathogen interaction, disease and their prevention

List of Practical:

1. Introduction to the world of fungi (Unicellular, coenocytic/septate mycelium, ascocarps basidiocarps.
2. Rhizopus: study of asexual stage from temporary mounts and sexual structures through permanent slides.
4. Saccharomyces, Aspergillus and Penicillium: study of asexual stage from temporary mounts. Study of Sexual stage from permanent slides/photographs.
5. Alternaria: Specimens/photographs and temporary mounts.
6. Colletotrichum: Study of symptoms of plants infected with Colletotrichum; asexual phase study through section/ temporary mounts
3. Puccinia: Herbarium specimens of Black Stem Rust of Wheat and infected Barberry leaves; sections/ mounts of spores on wheat and permanent slides of both the hosts.
7. Agaricus: Specimens of button stage and full grown mushroom; sectioning of gills of Agaricus, fairy rings and bioluminescent mushrooms to be shown. Albugo: Study of symptoms of plants infected with Albugo; asexual phase study through section/ temporary mounts and sexual structures through permanent slides.

8. Phytophthora: Study of symptoms of plants infected with Phytophthora; asexual phase study through section/ temporary mounts and sexual structures through permanent slides.
9. Lichens: Study of growth forms of lichens (crustose, foliose and fruticose) on different substrates. Study of thallus and reproductive structures (soredia and apothecium) through permanent slides. Mycorrhizae: ectomycorrhiza and endomycorrhiza (Photographs)
10. Phytopathology: Herbarium specimens of bacterial diseases; Citrus Canker; Angular leaf spot of cotton, Viral diseases: TMV, Vein clearing, Fungal diseases: Early blight of potato, Black stem rust of wheat and White rust of crucifers

Pattern of practical examination:

1. Identify, classify and write short morphological notes giving well labelled relevant diagrams on the given three specimens A, B and C. (9)
2. Identify giving two important characters of identification of the given spots 1, 2, and 3. (6)
3. Identify and comment upon the given plant diseases (Bacterial, viral and fungal- one each). (6)
4. Prepare temporary mount to identify causative organism from the given infected material and show it to the examiner. (2)
5. Field visit and collection records (4)
6. Practical records (4)
7. Viva-voce (4)

References/Suggested readings:

1. Alexopoulos, C.J., Mims, C.W. and Blackwell, M. (1996). Introductory Mycology 4thedition. John Wiley & Sons (Asia) Singapore.
2. Sharma, P.D. (2011). Plant Pathology. Rastogi Publication, Meerut, India.
3. Agrios, G.N. (1997). Plant Pathology, 4th edition. Academic Press, U.K.
4. Sethi, I.K. and Walia, S.K. (2011). Text book of Fungi and their Allies. Macmillan Publishers India Ltd.
5. Webster, J. and Weber, R. (2007). Introduction to Fungi, 3rd edition. Cambridge University Press, Cambridge.

Semester –II (Session: 2024-25)

Name of Program	**Bachelor of Science (Botany)**	**Program Code**	**USBT4**
Paper No.	**Paper 2 (Theory)**	**Nomenclature**	**Plant Genetics**
Name of the Course	**Discipline Specific Course (DSC A4)**	**Course Code**	**24BOTS402DS02**
Hours per Week	**02**	**Maximum Marks**	**50**
Credits	**02**	**Internal marks**	**15**
Time of Examinations	**03**	**External marks**	**35**

Note:
Examiner will set nine (09) questions and the candidates will be required to attempt five questions in all. Question number one (01) will be compulsory containing short answer type questions covering the entire syllabus from all units. Further, examiner will set two (02) questions from each unit and the candidates will be required to attempt one question from each Unit. All questions will carry equal marks.

Course Objectives:
To provide knowledge about the study of chromosomes, genes and their inheritance.

Course Learning Outcomes (CLO):
CLO1: Students will gain and understanding of the Mendelian genetics.

CLO2: Students will acquire the knowledge about extra chromosomal inheritance and gene mapping.

CLO3: Students will acquire knowledge about chromosomal aberrations and sex determination in plants.

CLO4: Students will develop an understanding of types of mutations and role of transposons.

CLO5: Students will acquire the knowledge of population and evolutionary genetics.

Unit 1

Mendelian genetics and its extension: Mendelism: History; Principles of inheritance; Chromosome theory of inheritance; Autosomes and sex chromosomes;
Probability and pedigree analysis; Incomplete dominance and co-dominance; Multiple alleles, Lethal alleles, Epistasis, Pleiotropy, Recessive and Dominant traits, Penetrance and Expressivity, Numericals; Polygenic inheritance.

Unit 2

Extrachromosomal Inheritance: Chloroplast mutation: Variegation in Four-o'-clock plant; Mitochondrial mutations in yeast; Maternal effects-shell coiling in snail; Infective heredity- Kappa particles in Paramecium.
Linkage, crossing over and chromosome mapping: Linkage and crossing over-Cytological basis of crossing over; Recombination frequency, two factor and three factor crosses;
Interference and coincidence; Numericals based on gene mapping; Sex Linkage.

Unit 3

Chromosomal aberrations: Structural and Numerical - deletions, duplications, translocations,

Position effect, inversions, aneuploidy, polyploidy. Specialized types of chromosomes: polytene, lampbrush, B-chromosomes. Sex chromosomes and Sex determination in Plants.

Gene mutations: Types of mutations; Molecular basis of Mutations; Mutagens – physical and chemical (Base analogs, deaminating, alkylating and intercalating agents); Detection of mutations: ClB method. Role of Transposons in mutation.

Unit 4

Fine structure of gene: Classical vs molecular concepts of gene; Cis-Trans complementation test for functional allelism; Structure of Phage T4, rII Locus. Population and Evolutionary Genetics: Allele frequencies, Genotype frequencies, Hardy- Weinberg Law, role of natural selection, mutation, genetic drift. Genetic variation and Speciation.

Semester –II (Session: 2024-25)

Name of Program	**Bachelor of Science (Botany)**	**Program Code**	**USBT4**
Paper No.	**Paper 2 (Practical)**	**Nomenclature**	**Plant Genetics**
Name of the Course	**Discipline Specific Course (DSC A4)**	**Course Code**	**24BOTS402DS02**
Hours per Week	**04**	**Maximum Marks**	**50**
Credits	**02**	**Internal marks**	**15**
Time of Examinations	**03**	**External marks**	**35**

Note:

Course Objectives:

To provide knowledge about the study of chromosomes, genes and their inheritance.

Course Learning Outcomes (CLO):

CLO1: Students will gain and understanding of the Mendelian genetics.

CLO2: Students will acquire the knowledge about extra chromosomal inheritance and gene mapping.

CLO3: Students will acquire knowledge about chromosomal aberrations and sex determination in plants.

CLO4: Students will develop an understanding of types of mutations and role of transposons.

CLO5: Students will acquire the knowledge of population and evolutionary genetics.

List of Practical:

1. Meiosis through temporary squash preparation.
2. Mendel's laws through seed ratios. Laboratory exercises in probability and chi-square.
3. Chromosome mapping using point test cross data.
4. Pedigree analysis for dominant and recessive autosomal and sex linked traits.
5. Incomplete dominance and gene interaction through seed ratios (9:7, 9:6:1, 13:3, 15:1, 12:3:1, 9:3:4).
6. Blood Typing: ABO groups & Rh factor.

7. Study of aneuploidy: Down's, Klinefelter's and Turner's syndromes.
8. Photographs/Permanent Slides showing Translocation Ring, Laggards and Inversion Bridge.
9. Study of human genetic traits: Sickle cell anemia, Xeroderma Pigmentosum, Albinism, red-green Colour blindness, Widow's peak, Rolling of tongue, Hitchhiker's thumb and Attached ear lobe.

Pattern of practical examination:

1. Numerical regarding Genetics (Polygenic inheritance / Gene mapping) as per syllabus. (8)
2. Identify and write brief note on given spots A, B and C (Permanent slide/Photograph) (6)
3. Preparation of Idiogram from a given karyotype photograph provided by examiner (3)
4. Identify and comment on spots related to genetic disorders (any two) (4)
5. One numerical related to Hardy- Weinberg Law (2)
6. Project Report (4)
7. Practical records (4)
8. Viva-voce (4)

References/Suggested readings:

1. Gupta, P.K. (2009). Genetics. Rastogi Publications, Meerut (India)
2. Snustad, D.P. and Simmons, M.J. (2010). Principles of Genetics. John Wiley & Sons Inc., India. 5th edition.
3. Klug, W.S., Cummings, M.R., Spencer, C.A. (2009). Concepts of Genetics. Benjamin Cummings, U.S.A. 9th edition.
4. Griffiths, A.J.F., Wessler, S.R., Carroll, S.B., Doebley, J. (2010). Introduction to Genetic Analysis. W. H. Freeman and Co., U.S.A. 10th edition.