



مولانا آزاد نیشنل اردو یونیورسٹی

MAULANA AZAD NATIONAL URDU UNIVERSITY

(A Central University established by an Act of Parliament in 1998)

(Accredited with 'A' Grade by NAAC)

B.Sc. Botany under CBCS

THREE-YEAR FULL-TIME PROGRAMME

Choice based credit system

(Six Semester Course)

**DEPARTMENT OF BOTANY
School of Sciences
II Floor, Polytechnic Building
MANUU, Gachibowli-Hyderabad**



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About the University

Maulana Azad National Urdu University is a Central University located in the city of Hyderabad in the Indian state of Telangana. It was named after Maulana Abul Kalam Azad, India's first Minister of Education, a freedom fighter in India's struggle for independence, and a scholar of Islam and Urdu literature. It was the only Urdu university in India until the second university was built in the city of Kurnool, Andhra Pradesh in 2015. The university was established by an Act of the Parliament in January 1998, with an All India jurisdiction to promote and develop the Urdu language and to impart vocational and technical Education in Urdu medium through conventional and distance modes. The university has been awarded "A" Grade by National Assessment & Accreditation Council (NAAC).



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About the Department

The Department of Botany established in the year 2014 and the first batch of Under Graduate course started in the same year. The main thrust area of teaching and research are Plant Physiology, Environmental Science, Biodiversity and Phytopathology. The Department is offering Environmental Studies (Ability Enhancement Compulsory Course) to Under Graduate students of the University. The Department of Botany in collaboration with O/o Dean, International Students holding Invited Talks/Lectures on current fields of Botany by inviting Resource Persons from India and outside the Country.

At present, 01 Professor, 02 Assistant Professors, 01 Guest Faculty with 01 supporting staff is working in the department. The departmental labs have well established and significant instrumentation facility to conduct experimental work. The Department has also organized Workshop, Symposium, Workshop, and Extension Lectures with the participation of faculty as well as students from the University. The highly competent faculty members of the Department are committed to provide hand-on training in the areas of cutting-edge research. The faculty members have excellent track records of high

quality publications in journal of international repute with fairly good citations and h-index.

The department has been identified for a special assistant grant by various funding agencies including UGC, ICSSR for Research Projects. The Department has academic autonomy and has been revising its syllabus as per its requirement and the department has also implemented CBCS system since 2014 as per UGC Guidelines. The Department has started Ph.D. program from 2018-19.



Prof. Salman Ahmad Khan
Dean, School of Sciences

Faculty/Staff of Botany Section



Prof. Maqbool Ahmed
Head of the Department



Dr. Merajul Islam Robab
Assistant Professor



Mrs. Ira Khan
Assistant Professor



Dr. Mohammad Faizan
Assistant Professor (Guest Faculty)

Semester System and Choice Based Credit System

The Indian higher education Institutions have been moving from the Conventional Annual System to Semester System. Maulana Azad National Urdu University has introduced Choice Based Credit System (CBCS) from the year 2019.

The credit based semester system provides flexibility in defining curriculum and assigning credits based on the course content and hours of teaching. The choice based credit system provides a cafeteria type approach in which the students can take courses of their choice, learn at their own pace, undergo additional courses and acquire more than the required credits and adopt in Inter dissatisfactory approach to learning.

Types of Courses

Courses in a programme may be of following:

- a) Core Course (CC):** Core course are offer in every semester (I to IV). This is the course which is to be compulsory studied by a student as a core required completing the requirement of a programme in a said discipline of study. (Each CC is of 4 credits).
- b) Discipline Specific Elective Courses (DSEC):** It shall be covered in two semesters (V and VI) of third year and the programme relevant to chosen disciplining core courses of the program. (Each DSE is of 4 credits).
- c) Skill Enhancement Courses (SEC):** SEC is another mandatory course. The candidate shall be opting one SEC paper from III semester to VI semester. (SEC is of 4 credits).
- d) Ability Enhancement Compulsory Course (AECC):** AECC are of two types
 - i. Communicative English for all UG students offered in the fifth semester**

ii. Environmental Studies is also compulsory course for all UG students offered in the second semester

e) Non-CGPA Credit Courses: It shall be covered in all semesters of the program mandatory requirement. These are classified into two categories as compulsory specified course with limited choice and elective course with multiple options from varied alternatives.

The university includes assigning an extra 5-10 of total credits for the NOOC'S subjects as approved by the respective Departments and also for vigorous participation of the students in identified/recognized Co and extra-curricular activities. Each of Non-CGPA Credit Courses will carry a weightage of 2 credits.

1. Compulsory Specified Courses: These are compulsory courses with limited choice and will be of 2 credits each to be opted by the students of all UG programs in any of the odd and semester amount to a total of 4 credits. Each student of UG program has to compulsorily either Islamic Studies or Comparative Studies of Religion OR Human Values and Ethics and acquires a total of 4 credits.

2. Elective Courses/Activities: These are part of Co- and Extra Curricular activities and each student must opt for a minimum 4 to 8 credits in entire duration of the programs.

(a) The identified MOOC's Subjects OR any other on-line courses offered by the recognized as credited University-enlisted by the Department/School.

(b) The approved Co- and Extra Curricular activities as defined by the Department/School/University

Core Course

1. Biodiversity (Microbes, Algae, Fungi, and Archegoniates)
2. Plant Anatomy and Embryology
3. Plant Ecology and Taxonomy
4. Plant Physiology and Metabolism

Discipline Specific Elective Courses:

1. Plant Genetics and Cell Biology
2. Economic Botany
3. Phyto Pathology
4. Seed Biology and Technology

Skill Enhancement Courses

1. Mushroom Culture and Technology
2. Plant Nursery and Gardening
3. Floriculture

Ability Enhancement Compulsory Courses

1. Communicative Studies
2. Environmental Studies

Non-CGPA Credit Courses

- a) Compulsory Specified Courses:

Islamic Studies/Comparative Studies of Religion/Human Values and Ethics

- b) Elective Courses/Activities

Co- and Extra Curricular activities, like Football, Cricket, Volley ball, script writing, etc.

Key words

- 1. Academic year:** Two consecutive (one even + one odd) semesters constitute one academic year.
- 2. Course:** Course usually referred to as “papers” is component of a programme.
- 3. Choice Based Credit System (CBCS):** The CBCS provides choice for students to select from the presented courses (core elective, minor or soft skill courses).
- 4. Credit:** A unit by which the course work is measured. It determines the number of hours of institutions required per week.

One credit is equal to 1 hour of Teaching/Theory

Two credits is equal to 4 hours of Practical's
- 5. Programme:** An educated programme leading to award of a degree, discipline or Certificate.
- 6. Semester:** Each semester is consisting of 15-18 weeks of Academic work evaluated to 90 actual teaching days.
- 7. Even Semester:** January to June
- 8. Odd Semester:** July to December

Program Name	Course Name	Semester	Credits	CBCS Type	Course Code
B.Sc. (ZBC)	Biodiversity (Microbes, Algae, Fungi, and Archegoniates)	1	4	Core Course	BSBT101CCT
B.Sc. (ZBC)	Biodiversity (Microbes, Algae, Fungi, and Archegoniates) Lab	1	2	Core Course	BSBT150CCP
B.Sc. (ZBC)	Plant Anatomy and Embryology	2	4	Core Course	BSBT201CCT
B.Sc. (ZBC)	Plant Anatomy and Embryology Lab	2	2	Core Course	BSBT250CCP
All UG Programs	Environmental Studies	2	2	Ability Enhancement	UGBT201AET
B.Sc. (ZBC)	Plant Ecology and Taxonomy	3	4	Core Course	BSBT301CCT
B.Sc. (ZBC)	Plant Ecology and Taxonomy Lab	3	2	Core Course	BSBT350CCP
All UG Programs	Mushroom Culture and Technology	3	2	Skill Enhancement	UGBT301SET
B.Sc. (ZBC)	Plant Physiology and Metabolism	4	4	Core Course	BSBT401CCT
B.Sc. (ZBC)	Plant Physiology and Metabolism Lab	4	2	Core Course	BSBT450CCP
All UG Programs	Bio Fertilizers	4	2	Skill Enhancement	UGBT401SET
B.Sc. (ZBC)	Plant Genetics and Cell Biology	5	4	Discipline Specific	BSBT501DST
B.Sc. (ZBC)	Plant Genetics and Cell Biology Lab	5	2	Discipline Specific	BSBT550DSP
B.Sc. (ZBC)	Economic Botany	5	4	Discipline Specific	BSBT502DST
B.Sc. (ZBC)	Economic Botany Lab	5	2	Discipline Specific	BSBT551DSP

All UG Programs	Nursery and Gardening	5	2	Skill Enhancement	UGBT501SET
B.Sc. (ZBC)	Seed Biology and Technology	6	4	Discipline Specific	BSBT601DST
B.Sc. (ZBC)	Seed Biology and Technology Lab	6	2	Discipline Specific	BSBT650DSP
B.Sc. (ZBC)	Phyto Pathology	6	4	Discipline Specific	BSBT602DST
B.Sc. (ZBC)	Phyto Pathology Lab	6	2	Discipline Specific	BSBT651DSP
All UG Programs	Floriculture	6	2	Skill Enhancement	UGBT601SET



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Department: Botany
Science

School: School of

UNDER GRADUATE PROGRAM	
Course code	Course title
BSBT101CCT	Biodiversity (Microbes, Algae, Fungi and Archegoniates)
BSBT150CCP	Biodiversity (Microbes, Algae, Fungi and Archegoniates) Lab
BSBT201CCT	Plant Anatomy and Embryology
BSBT250CCP	Plant Anatomy and Embryology Lab
UGBT201AET	Environmental Science
BSBT301CCT	Plant Ecology and Taxonomy
BSBT350CCP	Plant Ecology and Taxonomy Lab
UGBT301SET	Mushroom culture and Technology
BSBT401CCT	Plant Physiology and Metabolism
BSBT450CCP	Plant Physiology and Metabolism Lab
UGBT401SET	Biofertilizers and Compost
BSBT501DST	Plant Genetics and Cell Biology
BSBT550DSP	Plant Genetics and Cell Biology Lab
UGBT501SET	Nursery and Gardening
BSBT502DST	Economic Botany
BSBT551DSP	Economic Botany Lab
BSBT601DST	Seed Biology and Technology
BSBT650DSP	Seed Biology and Technology Lab
UGBT601SET	Floriculture
BSBT602DST	Phytopathology
BSBT651DSP	Phytopathology Lab

Structure of B.Sc. B.Z.C under Choice Based Credit System (CBCS) 2016 onwards

Se m.	Core Course (12)	CR	Ability Enhancement Compulsory Course (AECC) (8)	CR	Skill Enhancement Course (SEC) (any 2)	CR	Discipline Specific Elective Course (DSE) (6)	CR	Total CR/Sem.
I	1. Biodiversity (Microbes, Algae, Fungi and Archegoniatas)	4+2 4+2 4+2	English (Com.) Islamic Studies	4 2	-	-	-	-	22
II	2. Plant Anatomy and Embryology	4+2 4+2 4+2	Environmental Studies	4	-	-	-	-	22
III	3. Plant Ecology and Taxonomy	4+2 4+2 4+2			Mushroom Culture Technology	4	-	-	22
IV	4. Plant Physiology and Metabolism	4+2 4+2 4+2			Bio fertilizers and Compost	4	-	-	22
V	-	4+2 4+2	-	-	Nursery and Gardening	4	Economic Botany	4+2	22
VI	-	4+2 4+2	-	-	Floriculture	4	Seed Biology & Technology	4+2	22
Grand Total Credits									132

Note: 1 hr of Theory/week = 1 Credit; 4 hr of Practical/week = 2 Credits

Course Title: BIODIVERSITY (MICROBES, ALGAE, FUNGI AND ARCHEGONIATES) - (SEMESTER-I)

Course Code: BSBT101CCT

Scheme of Instruction

Total Duration	60 Hrs
Periods /Week	4
Credits	4
Instruction Mode	Lecture

Scheme of Examination

Maximum Score	100
Internal Evaluation	30
End Semester	70
Exam Duration	3 Hrs

Course Objectives: Study the diversity in habit, habitat and organisation of various groups of Microorganisms and plants like Algae, Fungi, Bryophytes and vascular cryptogams.

Course Outcomes: Students will understand the structure of Bacteria and Viruses. They understand the Morphological structure, reproductive structure of different groups of plants.

Unit	Course Content	Instruction Hours
1	Unit 1 : Microbes (Virus and Bacteria) Brief account of special group of Bacteria-Archaeobacteria, Mycoplasma, Chlamydia, Actinomycetes, Rickettsias and Cyanobacteria. Viruses Discovery, general structure, replication (general account) DNA virus (T-Phage); Life cycle of Viruses, RNA Virus (TMV), Economic importance. Bacteria- General characteristics and cell structure, Reproduction –Vegetative, Asexual and recombination (Conjugation, transformation and transduction), Economic importance.	15
2	Unit 2 :Thallophytes Algae General characters, thallus organization, structure, reproduction and classification. Life cycle of <i>Nostoc</i> , <i>Chlamydomonas</i> , <i>Chara</i> , <i>Fucus</i> and <i>Polysiphonia</i> . Economic importance of Algae. Fungi General characters, cell wall composition, nutrition, reproduction and classification. Life cycle of <i>Albugo</i> , <i>Pencillium</i> , <i>Puccinia</i> , <i>Alternaria</i> General account of Lichens & Mycorrhizae.	15
3	Unit 3 : Archegoniates-I : (Bryophytes and Pteridophytes) Bryophytes General characters, adaptations to land habit, classification, Morphology, anatomy and reproduction of <i>Marchantia</i> and <i>Polytrichum</i> . Economic importance of bryophytes and Sporophytic evolution in Bryophytes. Pteridophytes General characters, classification. Morphology, structure and reproduction of <i>Lycopodium</i> and <i>Marselia</i> .	15
4	Unit 4 : Archegoniates –II (Gymnosperms) Gymnosperms General characters, Classification. Morphology, anatomy and reproduction of <i>Pinus</i> and <i>Gnetum</i> . Economic importance of Gymnosperms.	15

Examination and Evaluation Pattern:

Text Books and References:

1	Alexopolous C.J and Mims C.V 1998 Introductory Mycology, John Wiley and sons.
2	Campbell, N.A and Reece. J.B (2008) Biology 8 th edition Pearson Benjamin Cummings San Francisco
3	Dubey RC and K K Maheshwari. A text Book if Microbiology: S Chand and Co. New Delhi.
4	Pandey and Trivedi- A text book of Fungi , Bacteria and Virus, Vikas Publishing House, New Delhi
5	A text book of Fungi by Vashita
6	Pelczar, M.J. (2001) Microbiology, 5 th edition, TataMc Graw Hi8ll Co, New Delhi.
7	Lee, R.E. (2008). Phycology, Cambridge University Press, Cambridge. 4th edition.
8	Prescott, L.M., Harley J.P., Klein D. A. (2005). Microbiology, McGraw Hill, India. 6th edition.
9	Webster, J. and Weber, R. 2007 Introduction to Fungi. 3 rd edition, Cambridge University Press, Cambridge.

Course Title: BIODIVERSITY (MICROBES, ALGAE, FUNGI AND ARCHEGONIATES LAB.) - (SEMESTER-I)

Course Code: BSBT150CCP

Scheme of Instruction		Scheme of Examination	
Total Duration	60 Hrs	Maximum Score	50
Periods /Week	4	Internal Evaluation	15
Credits	2	End Semester	35
Instruction Mode	Lecture/Demonstration	Exam Duration	3 Hrs

Course Objectives: To introduce the students about the diversity of organisms in the plant kingdom including Thallophytes, Bryophytes, Pteridophytes, and Gymnosperms.

Course Outcomes: Students are expected to familiarise with Morphological, Reproductive structures of different plant groups. They can able to prepare temporary stained slides of vegetative, reproductive parts of the different plant groups and can identify

Unit	Course Content	Instruction Hours
	<ol style="list-style-type: none"> Models of viruses-T phage and TMV, Photograph of Lytic and Lysogenic cycle. Types of Bacteria from temporary/permanent slides/photographs, slides of Binary fission, conjugation and structure of root nodule. Gram staining of Bacteria. Study of vegetative and reproductive structures of <i>Nostoc</i>, <i>Chlamydomonas</i>, <i>Chara</i>, <i>Fucus</i> and <i>Polysiphonia</i> temporary preparations and permanent slides. <i>Saccharomyces</i>, <i>Pencillium</i>, <i>Puccinia</i>, <i>Alternaria</i> Asexual and Sexual structures through permanent slides. Section cutting of the following fungal disease material and identification of pathogens: <i>Puccinia</i> and <i>Alternaria</i>. <i>Puccinia</i>: Black stem Rust of Wheat and infected Barberry leaves section mounts of spores on wheat and permanent slides of both the hosts. <i>Saccharomyces</i> and <i>Pencillium</i> Asexual and sexual structures through permanent slides. Lichens: Study of growth forms of lichens (Crustose, foliose and fruticose) specimens or slides. Mycorrhiza: ecto mycorrhiza and endo mycorrhiza (Photographs) <i>Marchantia</i>-morphology of thallus, w.m rhizoids and scales. W.m gemmae (all temporary slides). Antheriodiphore, Archegoniophore, sporophyte (all permanent slides). <i>Funaria</i>- morphology, w.m. leaf, rhizoids, operculum, peristome, annulus, spores (temporary slides); permanent slides showing antheridial and archegonial heads, L.S. capsule and protonema. <i>Marselia</i>: External morphology of sporophyte, anatomy of rhizome, petiole, and sporocarp. <i>Pinus</i>: external morphology, T.S of needle and stem, reproductive structures (Male and female cones). <i>Gnetum</i>: External morphology T.S of stem, reproductive structures (male and female cones). 	60Hrs

Text Books and References:

1	Alexopolous, C.J and Mims, C.V (1998). Introductory Mycology, John Wiley and sons.
2	Campbell, N.A and Reece, J.B (2008). Biology 8 th edition Pearson Benjamin Cummings San Francisco.
3	Dubey, R.C and Maheshwari, D.K. A text Book if Microbiology: S Chand and Co. New Delhi.
4	Pandey and Trivedi- A text book of Fungi, Bacteria and Virus. Vikas Publishing House, New Delhi.
5	A text book of Fungi by Vashita.
6	Pelczar, M.J (2001). Microbiology 5 th edition, TataMc Graw Hi8ll Co, New Delhi.
7	Campbell, H.D. The Evolution of land plants (Embryophyta), Uni. Press, Stanford.
8	Chopra, R.N and Kumar P.K (1998). Biology of Bryophytes. Wiley Eastern Ltd New Delhi.
9	Parihar, N.S (1965). An Introduction to Bryophyta Central Book Depot, Allahabad.
10	Sporne, K.R (1967). The Morphology Bryophytes, Hutchinson University Library, London.
11	Parihar, N.S. The Biology and Morphology of Pteridophytes, Central Book Depot. Allahabad.
12	O.P. Sharma. A Te4xt book of Pteridophyta Mac Millan India ltd. Delhi
13	Vashista PC Botany for Degree students-Gymnsoperms, S. Chand and co. New Delhi.
14	Bhatnagar, S.P and Alok Moitra (1997). Gymnosperms, New Age International (P) Ltd. Publisher, New Delhi
15	Clark KL 1976 Fossils, Palaeobotany and Evolution W.M.C. Brown company New York.
16	Misra SP and Shukla AC 1982 Essentials of Palaeobotany, Vikas Publishing House, New Delhi.

Course Title: PLANT ANATOMY AND EMBRYOLOGY (SEMESTER-II)**Course Code: BSBT201CCT****Scheme of Instruction**

Total Duration	60 Hrs
Periods /Week	4
Credits	4
Instruction Mode	Lecture

Scheme of Examination

Maximum Score	100
Internal Evaluation	30
End Semester	70
Exam Duration	3 Hrs

Course Objectives: Learn Anatomical structures and Functions of various tissues. Understand the Embryo and its structure, Embryo development in plants. To provide students with a fundamental understanding of study about the plant embryology.

Course Outcomes: students able to perform the transverse section of Root and Stem of monocot and dicot plants.

Unit	Course Content	Instruction Hours
1	Anatomy-I (Primary structure) Meristems Types, histological organization of shoot and root apices and theories. (Histogen theory, Tunica-carpus theory) Tissue & Tissue system: Simple Tissues (Parenchyma, Collenchyma, Sclerenchyma) Complex Tissues: Xylem and Phloem. Primary structure of Dicot and Monocot root, Stem and Leaf. Epidermis, cuticle, Stomata structure and types.	15
2	Anatomy-II (Secondary growth and wood anatomy) Stem and root: Vascular cambium - Formation and function, normal secondary growth of stem. Anomalous secondary growth of <i>Boerhavia stem</i> and Beet root Wood structure: General account (Heart wood and Sap wood)	15
3	Reproductive Botany -I Introduction to Embryology. Anther structure, Microsporogenesis and development of male gametophyte. Ovule structure and types, Megasporogenesis; types and development of female gametophyte.	15
4	Reproductive Botany -II Pollination - Types; Pollen - Pistil interaction. Fertilization. Endosperm - Development and types, embryo - development and types; Polyembryony and Apomixis - an outline. Palynology: Principles, pollen morphology and its applications.	15
Examination and Evaluation Pattern:		

Text Books and References:

1	Eames, A.J., & Mc Daniels, L.H.(1979) : An Introduction to Plant anatomy Tata-McGraw-Hill Publishing Co., (P) Ltd. Bombay, New Delhi. 14. Esau. K.(1980)
2	Plant Anatomy, (2nd Edition) Wiley Eastern Ltd., New Delhi.
3	Bhojwani, S.S. & Bhatnagar, S.P (2000). The Embryology of Angiosperms (4th Edition) Vikas Publishing House (P) Ltd., UBS Publisher's Distributors, New Delhi.
4	Maheswari, P (1985). An Introduction to the Embryology of Angiosperms Tata McGraw Hill Publishing Co., Ltd., New Delhi.
5	Dickinson, W.C. 2000 Integrative Plant Anatomy. Harcourt Academic Press, USA.
6	Esau, K. 1977 Anatomy of Seed Plants. Wiley Publishers.
7	Fahn, A. 1974 Plant Anatomy. Pergmon Press, USA and UK.
8	Mauseth, J.D. 1988 Plant Anatomy. The Benjammin/Cummings Publisher, USA.

COURSE TITLE: PLANT ANATOMY AND EMBRYOLOGY LAB (SEMESTER II)

Course Code: BSBT250CCP

Scheme of Instruction

Total Duration	60 Hrs
Periods /Week	4
Credits	2
Instruction Mode	Lecture/Demonstration

Scheme of Examination

Maximum Score	50
Internal Evaluation	15
End Semester	35
Exam Duration	3 Hrs

Course Objectives: Learn Anatomical structures and Functions Primary structure of stems and roots and also anomalous secondary growth of the stem and root. Understand the Embryo and its types.

Course Outcomes: After completion of the semester students able to perform the T.S of root and stem and also can differentiate the structure of root and shoot of monocot and dicot plants.

Unit	Course Content	Instruction Hours
I.	Demonstration of double staining technique.	60Hrs
II.	Anatomical study of the following primary structure of stems and roots: Sunflower, Maize	
III.	Study of anomalous secondary growth of the following taxa: Stem: <i>Boerhavia</i> Root: Beet root. Leaf: Dicot and Monocot leaf sections	
IV.	Study of Plant Tissues through permanent slides: Parenchyma, Collenchyma, Sclerenchyma, Tracheids, Vessels, thickening types on vessels.	
V.	Microscopic studies: stomata types: <i>Anomocytic, Anisocytic, Paracytic and Diacytic.</i>	
VI.	Types of Ovules: <i>Orthotropous, Anatropous, Hemi anatropous and Campylotropous.</i>	
VII.	Dissection of embryos: <i>Dicot embryo and Monocot embryo.</i>	
VIII.	Study of pollen morphology of <i>Hibiscus, Acacia, and Grass.</i>	

Course Title: PLANT ECOLOGY AND TAXONOMY (SEMESTER III)**Course Code: BSBT301CCT****Scheme of Instruction**

Total Duration	60 Hrs
Periods /Week	4
Credits	4
Instruction Mode	Lecture

Scheme of Examination

Maximum Score	100
Internal Evaluation	30
End Semester	70
Exam Duration	3 Hrs

Course Objectives: Learn about Environment and Environmental factors, types of Ecosystems. Understand the basic techniques in preparation of Herbarium and family description.

Course Outcomes: Learn about the techniques of developing Herbarium. Students able to write vegetative and floral characters of plants and students will come to know about the bio geographical zones and endemism phenomenon.

Unit	Course Content	Instruction Hours
1	Unit 1: Introduction, Ecological factors and Plant communities: Introduction of Plant Ecology, Ecological factors like Soil, Water, Light and Temperature. Soil: Origin, formation, composition, soil profile, soil erosion and conservation. States of water in the Environment, precipitation types. Plant habitats,-their types. Adaptations of Hydrophytes and Xerophytes. Plant Communities characters, Ecotone and edge effect, Succession processes and types.	15
2	Unit 2 : Ecosystem and phytogeography: Ecosystem structure, Energy flow, Food chains and Food webs, Ecological pyramids production and productivity, biogeochemical cycles, Carbon, Nitrogen and Phosphorous cycles. Principle biogeographical zones, Endemism.	15
3	Unit 3: Introduction to Plant Taxonomy and Herbarium: Identification, Classification, Nomenclature, Principles and rules(ICN), ranks and names, Binomial system, typification, author citation, valid publication, principle of priority and its limitations. Functions of Herbaria, important of herbaria and botanical gardens of the world and India.BSI, Documentation: Flora, keys: single access and multi-access.	15
4	Unit 4: Classification and Families: Types of classification-artificial, natural and phylogenetic. Bentham and Hooker (up to Series) & Engler and Prantl (up to Series/Order) classification. Systematic study and economic importance of plants belonging to the following families: Polypetalae: Annonaceae, Rutaceae , Fabaceae, Caesalpinaceae, Mimosaceae and Cucurbitaceae/ Umbelliferae. Gamopetalae: Asteraceae, Asclepiadaceae. Monochlamydeae: Euphorbiaceae. Monocotyledons: Poaceae.	15

Text Books and References:

1	Kormondy, E.J. (1996). Concepts of Ecology. Prentice Hall, U.S.A. 4th edition.
2	Simpson, M.G. (2006). Plant Systematics. Elsevier Academic Press, San Diego, CA, U.S.A.
3	Sharma, P.D. (2006) Ecology and Utilization of Plants. Rastogi Publications, Shivaji Road, Meerut
4	Wilkinson, D.M. (2007). Fundamental Processes in Ecology: An Earth Systems Approach. Oxford University Press. U.S.A.
5	Sharma, P.D. (2010) Ecology and Environment. Rastogi Publications, Meerut, India. 8th edition.
6	Singh, G. (2012). Plant Systematics: Theory and Practice. Oxford & IBH Pvt. Ltd., New Delhi. 3rd edition.

Course Title: PLANT ECOLOGY AND TAXONOMY LAB (III SEMESTER)

Course Code: BSBT350CCP

Scheme of Instruction

Total Duration	60 Hrs
Periods /Week	4
Credits	2
Instruction Mode	Lecture

Scheme of Examination

Maximum Score	50
Internal Evaluation	15
End Semester	35
Exam Duration	3 Hrs

Course Objectives: Learn about Environment and Environmental factors, types of Ecosystems. Understand the basic techniques of analysis of soil samples and also in preparation of Herbarium.

Course Outcomes: Learn about the techniques of developing Herbarium. Students can able to differentiate root and stem parasites and understand about the morphological adaptations of hydrophytes and xerophytes.

Unit	Course Content	Instruction Hours
	<ol style="list-style-type: none">1. Study of instruments used to measure microclimatic variables: Soil thermometer, maximum and minimum temperature, anemometer, psychrometer/hygrometer, rain gauge and lux meter.2. Determination of pH, and analysis of two soil samples for carbonates, chlorides, nitrates, sulphates, organic matter and base deficiency by rapid field test.3. Study of morphological adaptations of hydrophytes and xerophytes (four each)4. Study of biotic interactions of the stem parasite (Cuscuta), Root parasite (Orobanch), Epiphytes, Predation (Insectivorous plants).5. Study of vegetative and floral characters of the following families: Annonaceae, Rutaceae , , Fabaceae,Caesalpinaceae, Mimosaceae and Cucurbitaceae/ Umbelliferae, Asteraceae, Asclepiadaceae, Euphorbiaceae and Poaceae.(As per the availability of plant species)6. Mounting of a properly dried and pressed specimen of plants belongs to above families on herbarium sheets.	60Hrs

Examination and Evaluation Pattern:

Text Books and References :

Course Title: PLANT PHYSIOLOGY AND METABOLISM (SEMESTER IV)**Course Code: BSBT401CCT****Scheme of Instruction**

Total Duration	60 Hrs
Periods /Week	4
Credits	4
Instruction Mode	Lecture

Scheme of Examination

Maximum Score	100
Internal Evaluation	30
End Semester	70
Exam Duration	3 Hrs

Course Objectives: To understand the Physiological process in plants like anabolism, catabolism and metabolism and also metabolic activities in plants.

Course Outcomes: Learn about the various mechanisms in plants taking from transpiration to growth metabolism. Understand how the intermediate products of various mechanisms are linked to each other and also act as a precursor in developing some other products.

Unit	Course Content	Instruction Hours
1	Water Relations: Plant water relations, importance of water, water potential and its components. Transpiration and its significance, factors effecting transpiration, root pressure and Guttation. Mineral nutrition: Essential elements, macro and micronutrients; Criteria of essentiality of elements; Role of essential elements; Transport of ions across cell membrane, active and passive transport, carriers, channels and pumps.	15
2	Photosynthesis: Photosynthetic Pigments (Chl a, b, xanthophylls, carotene); Photosystem I and II, reaction center, antenna molecules; Electron transport and mechanism of ATP synthesis; C3, C4and CAM pathways of carbon fixation; Photorespiration. Respiration: Aerobic and Anaerobic; Glycolysis, Krebs cycle; electron transport system, Glyoxalate mechanism, Pentose Phosphate pathway.	15
3	Enzymes: Structure, properties and Mechanism of enzyme catalysis and enzyme inhibition Nitrogen Metabolism: Biological nitrogen fixation: nitrate and ammonia assimilation.	15
4	Plant growth regulators: discovery and physiological roles of - Auxins, Gibberellins, Cytokinins, ABA and ethylene. Physiology of flowering plants: Photoperiodism, role of phytochrome in Flowering.	15

Examination and Evaluation Pattern:

Text Books and References:

1	Lawlor, D.W. (1989). Photosynthesis, metabolism, Control & Physiology ELBS/Longmans-London.
2	Plummer, D. (1989). Biochemistry—the Chemistry of life, McGraw Hill Book Co., London, N.Y. New Delhi, Paris, Singapore, Tokyo.
3	Mukherjee, S. Ghosh, A.K. (1998). Plant Physiology, Tata McGraw Hill Publishers (P) Ltd., New Delhi.
4	Salisbury, F.B & C.W. Ross (1999). Plant Physiology CBS Publishers and Printers, New Delhi.
5	Bajracharya D. (1999). Experiments in Plant Physiology-A Laboratory Manual. Narosa Publishing House, New Delhi.
6	Day, P.M. & Harborne, J.B. (2000). Plant Biochemistry. Harcourt Asia (P) Ltd., India & Academic Press, Singapore.
7	Srivastava, H.S. (2008). Plant Physiology and Biochemistry. Rastogi Publication, Meerut.
8	Hopkins, W.G. & Huner, A. (2008). Introduction to Plant Physiology. John Wiley and Sons. U. S.A. 4th edition.
9	Pandey, S.N. & Sinha, B.K. (2009). Plant Physiology. Vikas Publishing House, Pvt. Ltd. New Delhi 680 pp.
10	Taiz, L., Zeiger, E., Møller, I.M. and Murphy, A (2015). Plant Physiology and Development. Sinauer Associates Inc. USA. 6th edition.

Course Title: PLANT PHYSIOLOGY AND METABOLISM LAB (SEMESTER IV)**Course Code: BSBT450CCP****Scheme of Instruction**

Total Duration	60 Hrs
Periods /Week	4
Credits	2
Instruction Mode	Lecture/Demonstration

Scheme of Examination

Maximum Score	50
Internal Evaluation	15
End Semester	35
Exam Duration	3 Hrs

Course Objectives: To understand the Physiological processes in plants like osmosis, photosynthesis, respiration by use of physiological instruments.

Course Outcomes: Students expected to learn about procedure to observe the viability of seeds, determination of rate of transpiration and other physiological processes.

Unit	Course Content	Instruction Hours
	List of Experiments <ol style="list-style-type: none">1. Osmosis – by potato Osmoscope experiment2. To Study the phenomenon of Plasmolysis by using Rhoea/Tradescantia plant.3. Determination osmotic potential of cell sap by plasmolysis method.4. Determination of rate of transpiration by using cobalt chloride method.5. Calculation of stomatal index, frequency.6. Demonstration of respiratory enzyme (catalase) in Plant tissues..7. Separation of chloroplast pigments using paper chromatography technique.8. Testing of seed viability using 2,3,5 triphenyl tetrazolium chloride(TTC).9. Determination of Transpiration rate by Ganongs Potometer.	60Hrs
Examination and Evaluation Pattern:		

Text Books and References:

1	Bajracharya D. (1999). Experiments in Plant Physiology-A Laboratory Manual. Narosa Publishing House, New Delhi.
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Course Title: PLANT GENETICS AND CELL BIOLOGY (SEMESTER V)**Course Code: BSBT501DST****Scheme of Instruction**

Total Duration	60 Hrs
Periods /Week	4
Credits	4
Instruction Mode	Lecture

Scheme of Examination

Maximum Score	100
Internal Evaluation	30
End Semester	70
Exam Duration	3 Hrs

Course Objectives: To learn about the various aspects of Plant Genetics.
To know the components and structure of plant and animal cell and its organelles.

Course Outcomes: Students able to understand Mendelism and laws of inheritance.
Mutations and mutagenic factors and also the importance of semi autonomous nature of cell organelles.

Unit	Course Content	Instruction Hours
1	Mendelism and laws of Inheritance: History; Principles of inheritance; Chromosome theory of inheritance; Autosomes and sex chromosomes; Incomplete dominance and codominance; Multiple alleles, Lethal alleles, Epistasis, Pleiotropy and Polygenic Inheritance. Extra chromosomal Inheritance Chloroplast mutation: Variegation in Four o'clock plant	15
2	Linkage, crossing over, chromosome mapping and Sex Linkage. Variation in chromosome number and structure. Deletion, Duplication, Inversion, Translocation, Position effect, Euploidy and Aneuploidy. Gene mutations, Types of mutations; Mutagens – physical and chemical (Base analogs, deaminating, alkylating and intercalating agents).	15
3	Cell as a unit of structure and function; Characteristics of prokaryotic and eukaryotic cells; Origin of eukaryotic cell (Endosymbiotic theory). Structure and function of Plant cell wall. Overview of membrane function; fluid mosaic model; Chemical composition of membranes; Membrane transport – Passive, active and facilitated transport, endocytosis and exocytosis.	15
4	Nucleus and Nucleolus Structure and function. Cytoskeleton: Role and structure of microtubules, microfilaments and intermediary filament. Structural organization and Functions of Chloroplast, mitochondria and peroxisomes; Semiautonomous nature of mitochondria and chloroplast. Structure and Functions of Endoplasmic Reticulum (Smooth ER and Rough ER), Golgi apparatus and Lysosomes. Cell division: mitosis and meiosis, Cell Cycle.	15
Examination and Evaluation Pattern:		

Text Books and References:	
1	Power C.B., 1984, Cell Biology, Himalaya Publishing Co. Mumbai
2	De. Robertis & De Robertis, 1998, Cell and Molecular Biology, K.M. Varghese and Company.
3	Gardner, E.J & Snusted, D.P. (1984). Principles of Genetics (7th edition) John Wiley & Sons, N.Y. Chichester, Brisbane, Toronto, Singapore.
4	Borojevic, S. (1990). Principles and Methods of Plant Breeding. Elsevier New York.
5	Allard, R.W. (1960). Principles of Plant Breeding. John Wiley and Sons Inc, New York, 485 pp.
6	Vijendra Das, L.D. (2000). Problem Facing Plant Breeding. Jain for CBS Publishers and Distributors.
7	Waseem, A.F. (2013). Genetics and Genomics. Pearson Education Dorling Kindersley (India) New Delhi. 1st Edition.
8	Verma, P.S. & Agarwal, V.K. (2009). Genetics. S. Chand and Company Ltd. Ramnagar, New Delhi. 9th Edition.
9	Klug, W.S., Cummings, M.R., Spencer, C.A. (2009). Concepts of Genetics. IX Edition. Benjamin Cummings.
10	Russell, P. J. (2009). Genetics- A Molecular Approach. III Edition. Benjamin Cummings.
11	Snustad, D.P. & Simmons, M.J. (2010). Principles of Genetics, John Wiley & Sons Inc., India. 5th edition.
12	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.
13	Klug, W.S., Cummings, M.R., Spencer, C.A. (2012). Concepts of Genetics. Benjamin Cummings, U.S.A. 10th Edition.

Course Title: PLANT GENETICS AND CELL BIOLOGY LAB (SEMESTER V)

Course Code: BSBT550DSP

Scheme of Instruction

Total Duration	60 Hrs
Periods /Week	4
Credits	2
Instruction Mode	Lecture/Demonstration

Scheme of Examination

Maximum Score	50
Internal Evaluation	15
End Semester	35
Exam Duration	3 Hrs

Course Objectives:

Course Outcomes:

Unit	Course Content	Instruction Hours
	List of Experiments 1. Mitosis and Meiosis through temporary squash preparation. 2. Mendel's laws through seed ratios. Laboratory exercises in probability and chi-square. 3. Incomplete dominance and gene interaction through seed ratios (9:7, 9:6:1, 13:3, 15:1, 12:3:1, 9:3:4). 5. Photographs/Permanent Slides showing Translocation Ring, Laggards and Inversion Bridge.	60Hrs
Examination and Evaluation Pattern:		

Text Books and References:	
1	

Course Title: ECONOMIC BOTANY (Semester V)**Course Code: BSBT502DST****Scheme of Instruction**

Total Duration	60 Hrs
Periods /Week	4
Credits	4
Instruction Mode	Lecture

Scheme of Examination

Maximum Score	100
Internal Evaluation	30
End Semester	70
Exam Duration	3 Hrs

Course Objectives: To know the Economic importance of plants and also to study the morphology and useful parts of plants.

Course Outcomes: Learn about the different kinds of plants and their role in industries, Pharmaceuticals and also in preparation various kinds of products useful for human welfare.

Unit	Course Content	Instruction Hours
1	Origin of Cultivated Plants Concept of Cultivation of Plants Importance of Cultivation of Plants (World wide cultivation)	15
2	Morphology & Economic Importance of following plants: Cereals: Wheat and Rice Millets: Jowar and Bajra Pulses: Chick pea, Pigeon pea and fodder legumes and Biological Nitrogen fixation Fruits: Two locally available fruits	15
3	Morphology & Economic Importance of following plants: Oils: Groundnut, Linseed, Soybean, Mustard and Coconut Natural rubber Gums and Resins. Fibers: Cotton, Coir and Jute.	15
4	Morphology & Economic Importance of following plants: Beverages: Tea and Coffee Spices: Fennel, Saffron, Clove and black pepper. Drugs: Cinchona, Digitalis and Tobacco. Timber Plants: Teak and Pine.	15
Examination and Evaluation Pattern:		

Text Books and References:	
1	Jain, S.K. (1981). Glimpses of Indian Ethnobotany. Oxford & IBH, New Delhi.
2	Sambamurthy, A.V.V.S. & Subrahmanyam, N.S. (1989). A Text Book of Economic Botany. Wiley Eastern Ltd., New Delhi.
3	Edmondson, A. & Druce, D. (1996). Advanced Biology Statistics Oxford University Press.
4	Bendre, A. & Kumar, A. (1998-99). Economic Botany. Rastogi Publications, Meerut, India.
5	Jain, S.K. & Mundgal, (1999). Handbook of Ethnobotany London.
6	Pandey, B.P. (2000). Economic Botany S. Chand & Co., New Delhi.
7	Wickens, G.E. (2001). Economic Botany: Principles & Practices. Kluwer Academic Publishers, The Netherlands.
8	Kochhar, S.L. (2012). Economic Botany in Tropics, MacMillan & Co. New Delhi, India.
9	Chrispeels, M.J. and Sadava, D.E. (2003). Plants, Genes and Agriculture. Jones & Bartlett Publishers.

Course Title: ECONOMIC BOTANY LAB (Semester V)**Course Code: BSBT551DSP****Scheme of Instruction**

Total Duration	60 Hrs
Periods /Week	4
Credits	2
Instruction Mode	Lecture/Demonstration

Scheme of Examination

Maximum Score	50
Internal Evaluation	15
End Semester	35
Exam Duration	3 Hrs

Course Objectives:**Course Outcomes:**

Unit	Course Content	Instruction Hours
	List of Experiments <ol style="list-style-type: none"> 1. Cereals: Wheat (habit sketch, L. S/T.S. grain, starch grains, micro-chemical tests) Rice (Habit sketch, study of paddy and grain, starch grains, micro-chemical tests). 2. Legumes: Soybean, Groundnut, (habit, fruit, seed structure, micro-chemical tests). 3. Sources of sugars and starches: Sugarcane (habit sketch; cane juice-micro-chemical tests). 4. Spices: Black pepper, Fennel and Clove (habit and sections). 5. Beverages: Tea (plant specimen, tea leaves), Coffee (plant specimen, beans). 6. Sources of oils and fats: Coconut- T.S. nut, Mustard-plant specimen, seeds; tests for fats in crushed seeds. 7. Rubber: specimen, photograph/model of tapping, samples of rubber products. 8. Drug-yielding plants: Specimens of Digitalis, Cinchona. 9. Tobacco: specimen and products of Tobacco. 10. Woods: Tectona, Pinus: Specimen, Section of young stem. 11. Fiber-yielding plants: Cotton (specimen, whole mount of seed to show lint and fuzz; whole mount of fiber and test for cellulose), Jute (specimen, transverse section of stem, test for lignin on transverse section of stem and fiber). 	60Hrs
Examination and Evaluation Pattern:		

Text Books and References:

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Course Title: SEED BIOLOGY AND TECHNOLOGY (Semester VI)**Course Code: BSBT601DST****Scheme of Instruction**

Total Duration	60 Hrs
Periods /Week	4
Credits	4
Instruction Mode	Lecture

Scheme of Examination

Maximum Score	100
Internal Evaluation	30
End Semester	70
Exam Duration	3 Hrs

Course Objectives:**Course Outcomes:**

Unit	Course Content	Instruction Hours
1	Flower biology& Seed formation. Seed structure and seed types, seed dormancy, causes and methods of breaking seed dormancy. Seed storage: Orthodox and recalcitrant seeds. Seed viability, Factors affecting seed viability and genetic erosion.	15
2	Seed sampling-Method of sampling-Seed purity, Seed germination. Cultural practices and Harvesting of seed: Isolation, Sowing, Cultural practices, harvesting and threshing of the following crops: Paddy, Cotton and Sunflower.	15
3	Study of Seed borne pathogens one each from Fungi, Bacteria, Mycoplasma Like Organisms, Fastidious, Vascular Bacteria, Spiroplasmas, Viruses, Viroids and Nematodes. Seed treatment to control seed borne diseases-General account. Cross pollination, Hybrid seed production and Heterosis.	15
4	Seed Production Technology, Procedures of seed testing, Seed Testing Laboratories. Seed Certification-Objectives-Concept of seed certification. Seed banks-National, International and Millenium seed banks.	15
Examination and Evaluation Pattern:		

Text Books and References:

1	Agarwal, P.K. (1993). Hand Book of Seed Technology, Dept of Agriculture and Cooperation, National Seed Corporation Ltd, New Delhi.
2	Bewley, J.D & Black, M. (1985). Seed Physiology of development and germination, Plenum Press, New York.
3	Padmavathi, S. Prakash, M. Ezhil Kumar, S. Sathiyarayanan, G. Kamaraj, A. (2012). A Text Book of Seed Science and Technology. New Delhi Publishing Agency, New Delhi 88, India.
4	Singh, P. (2015). Principles of Seed Technology. Indian Council of Agricultural Research.
5	Agarwal, R.L. (2018). Seed Technology. Oxford and IBH publishing co-pvt Ltd.

Course Title: SEED BIOLOGY AND TECHNOLOGY LAB (Semester VI)

Course Code: BSBT650DSP

Scheme of Instruction

Total Duration	60 Hrs
Periods /Week	4
Credits	2
Instruction Mode	Lecture/Demonstration

Scheme of Examination

Maximum Score	50
Internal Evaluation	15
End Semester	35
Exam Duration	3 Hrs

Course Objectives:

Course Outcomes:

Unit	Course Content	Instruction Hours
	List of Experiments <ol style="list-style-type: none">1. Testing of seed viability using 2,3,5 Tri phenyl tetrazolium chloride.2. Estimation of amylase activity of germinating seeds.3. Demonstration of seed dressing using fungicides to control plant diseases.4. Demonstration of Emasculation, bagging techniques for hybrid seed production.5. Dissection of Dicot and Monocot embryo.6. Study of types of Ovules through slides and charts.7. Seed coat anatomy of Castor and Annona	60Hrs

Course Title: PHYTOPATHOLOGY (Semester VI)**Course Code: BSBT602DST****Scheme of Instruction**

Total Duration	60 Hrs
Periods /Week	4
Credits	4
Instruction Mode	Lecture

Scheme of Examination

Maximum Score	100
Internal Evaluation	30
End Semester	70
Exam Duration	3 Hrs

Course Objectives: To acquire information about the different types of plant diseases. To understand the classification of plant pathogens, diseases and control measures.

Course Outcomes: Learn about the different kinds of pathogens and their role in developing symptoms and diseases. Measures to control plant diseases.

Unit	Course Content	Instruction Hours
1	Introduction & Plant pathogens: History of Plant Pathology, Classification of Plant Diseases. Some important plant pathogens like Fungi, Bacteria, Phytoplasmas, Spiroplasmas, Viruses, Viroids, Algae, protozoa and Phanergamic parasites with examples of diseased caused by them. Transmission of plant viruses, symptoms caused by Plant Viruses.	15
2	Pathogenesis, Enzymes and Defence mechanism: Penetration and entry of plant pathogens and its development inside host tissue. Role of Enzymes, Growth regulators and Toxins in pathogenesis. Host- Parasite interaction and defence Mechanism (histological, physiological and biochemical) Defence mechanism in plants-Structural and Biochemical.	15
3	Detailed study of the following plant diseases: Bacterial diseases – Citrus canker and angular leaf spot of cotton. Viral diseases – Tobacco Mosaic viruses, vein clearing. Fungal diseases – White rust of crucifers Early blight of potato. Mycoplasmal diseases: sandal spike, Grassy shoots disease of sugarcane.	15
4	Management of Plant diseases: General principles of plant diseases management-importance, general principles-avoidance, exclusion, eradication, protection and therapy. Introduction of Pest resistance GM Crops. Regulatory methods-Plant Quarantine and inspection. Cultural methods-Rouging, eradication of alternate and collateral host, crop rotation, manure and fertilizer management, mixed cropping, sanitation etc.	15
Examination and Evaluation Pattern :		

Text Books and References:	
1	Yu. T. Dyakov, V.G. Dzhavakhiya, T. Korpela (2007). Comprehensive and Molecular Phytopathology.
2	Vishnavat, K. & Kolte, S.J. (2012). A Text Book of Comprehensive Plant Pathology. Kalyani Publishers.
3	Ghatak, A. & Ansar, M. (2017). The Phytopathogen, Evolution and Adaptation. Apple Academic Press Inc. CRC Press, Taylor & Francis Group.
4	P.D. Sharma (2017). Mycology and Phytopathology. Rastogi Publication.
5	S. Pradhan (2021). Mycology and Phytopathology. Academic Aspirations. 1st Edition.

Course Title: PHYTOPATHOLOGY LAB (Semester VI)**Course Code: BSBT651DSP****Scheme of Instruction**

Total Duration	60 Hrs
Periods /Week	4
Credits	2
Instruction Mode	Lecture/Demonstration

Scheme of Examination

Maximum Score	50
Internal Evaluation	15
End Semester	35
Exam Duration	3 Hrs

Course Objectives: To understand the bacterial, viral fungal diseases and their symptoms and causal organism.

Course Outcomes: Learn about the identification diseases on the basis of symptoms and also techniques for isolation of Bacteria and fungi from the soil.

Unit	Course Content	Instruction Hours
	List of Experiments <ol style="list-style-type: none">1. Phytopathology: Herbarium specimens of bacterial diseases; Citrus Canker; Angular leaf spot of cotton, Viral diseases: TMV, Vein clearing, and Fungal diseases: Early blight of potato, Black stems rust of wheat and White rust of crucifers.2. Microscopic observation Of Fungal disease Slides like <i>Puccinia</i> (Wheat Rust) <i>Alternaria</i>, <i>Albugo</i> (White Rust) <i>Phytophthora infestance</i> (Late Blight of Potato)3. Isolation and Enumeration of Bacteria from soil.4. Isolation and Enumeration of Fungi From soil.5. Anatomical Studies on leaves infected with Fungal Pathogens like Tikka disease of Ground nut.6. Counting of Fungal spore by Haemocytometre.	60Hrs
Examination and Evaluation Pattern:		

Text Books and References:	
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2	