# ALAGAPPA UNIVERSITY

(A State University Established in 1985)

Karaikudi - 630003. Tamil Nadu, India

2017 Accredited with A+ Grade by NAAC (CGPA : 3.64)

2018 MHRD Govt. of India UGC Graded as Category - I Granted Autonomy

2018 MHRD Swachh Campus Rank : 4

2021 nirf National Institutional Ranking Framework Rank : 33

2021 QS University Rankings Asia Rank : 199

## FACULTY OF SCIENCE

## DEPARTMENT OF BOTANY


## M.Phil., BOTANY

# REGULATIONS AND SYLLABUS

(For the candidates admitted from the Academic Year 2022 - 2023)

**DEPARTMENT OF BOTANY**

**M.PHIL. BOTANY**

# REGULATIONS AND SYLLABUS

[For the candidates admitted from the Academic Year 2022 – 2023 onwards]


## ALAGAPPA UNIVERSITY

(A State University Accredited with "A+" grade by NAAC (CGPA: 3.64) in the Third Cycle and Graded as Category-I University by MHRD-UGC)

Karaikudi - 630003, Tamil Nadu

# REGULATIONS AND SYLLABUS

*[For the candidates admitted from the academic year 2022 onwards]*

## Regulations

**1. Eligibility for admission**

A candidate who has passed PG Degree with botany/ Plant Science /Plant Biotechnology as the main subject of Study at any University/colleges shall be permitted to appear and qualify for the entrance examination for the M. Phil., Botany. Admission shall be based on the merit list of the entrance examination.

**2. Duration of Course**

The course shall consist of one academic year divided into two semesters. Each semester consists of 90 working days.

**3. Teaching Methods**

The classroom teaching would be through conventional lectures, use of Power-Point presentation, and novel, innovative teaching ideas like, smartboard, and computer-aided instructions. Periodic field visits enable the student for gathering practical experience and up to date industrial scenario. Student seminars would be arranged to improve their awareness and communicative skill. In the laboratory, instructions would be given for the safe handling of chemicals and instruments. The students shall be trained to handle advanced instrumentation facilities. The periodic test would be conducted for students to assess their knowledge gaining process.

## 4. Programme General Objectives (PGO)

| | |
|---|---|
| PGO-1 | To initiate research capacity and capability among the M.Phil. students of Botany. |
| PGO-2 | Preparing students to carry out their higher research programs like Ph. D. programme. |
| PGO-3 | To provide scope to understand the modern tools and techniques for research work in various fields of Botany. |
| PGO-4 | To collect and interpret the theories and principles written in the collected literature related to research work. |
| PGO-5 | To motivate and mentor the students to develop mentoring skills with respect to research project proposals and research reports like dissertations and thesis. |

## 5. Programme Specific Objectives (PSO)

| | |
|---|---|
| PSO-1 | To provide the opportunity to acquire or develop skills and expertise relevant to their research interests. |
| PSO-2 | To develop skills in literature survey, identify new methodologies, data collection and analysis, and presentation of research findings. |
| PSO-3 | To conduct basic or applied research in the discipline Botany which has societal and environmental values. |
| PSO-4 | To gain training in new and advanced techniques, methods and procedures emerging in Biological science. |
| PSO-5 | To extend the spectrum of scientific thought and scientific communication. |

## 6. Programme Outcome (PO)

| | |
|---|---|
| PO-1 | Apply the scientific context to develop innovative ideas, products and methods for the benefits of the society and environment. |
| PO-2 | Formulate hypothesis and conduct research using appropriate tools and techniques within their focused area of study. |
| PO-3 | Publication of their results from the research work in peer-reviewed journals to benefit society and future endeavors in research. |
| PO-4 | Demonstrate a broad understanding of the facts and the experimental basis of modern Botany. |

## 7. Examinations

The examinations shall be conducted for theory courses to assess the knowledge acquired during the study. There shall be two systems of examinations viz., internal and external examinations. The internal examinations shall be conducted as Continuous Internal Assessment tests I and II (CIA Test I & II). The internal assessment shall comprise of maximum 25 marks for each subject. The following procedure shall be followed for awarding internal marks.

**Theory paper (Internal Assessment)**

| | |
|---|---|
| Average marks of two CIA tests | 10 marks |
| Attendance | 5 marks |
| Seminar/group discussion/quiz | 5 marks |
| Assignment/case study/field report | 5 marks |
| **Total** | **25 marks** |

## 8. Scheme of External examination

The duration of examinations for theory shall be three hours.

**Question paper pattern (Theory)**

Five Questions – Internal Choice (Either or Pattern) – 5 x 15 = 75 Marks

## 9. Passing minimum

**a)** For Internal and External Examination, Passing Minimum shall be of 50% (Fifty Percentage) of the maximum marks prescribed for the paper.

**b)** In the aggregate (External + Internal), the passing minimum shall be of 50% for each Paper/Project and Viva-voce.

**c)** Grading shall be based on overall marks obtained (internal + external).

## 10. Dissertation Work (Maximum Marks: 200)

The duration of the Dissertation Work shall be a minimum of six months in the even semester.

**a) Plan of work**

The candidate shall undergo Dissertation Work during the second semester. The

candidate should prepare a scheme of work for the dissertation and should obtain approval from the guide. The candidate, after completing the dissertation work, shall be allowed to submit to the university at the end of the second semester. If the candidate is desirous of availing the facility from other Universities/laboratories, they will be permitted only after getting approval from the guide. In such a case, the candidate shall acknowledge the same in their dissertation.

**b) No. of copies of the dissertation**

The candidate should prepare three copies of the dissertation and submit the same for evaluation of examiners. After evaluation, one copy will be retained in the department library, and one copy shall be held by the student.

**c) Format to be followed for dissertation**

The format /certificate for dissertation to be followed by the student is given below

- Title page
- Certificate
- Acknowledgment
- Content as follows

| Chapter No | Title | Page No |
|---|---|---|
| 1 | Introduction | |
| 2 | Review of Literature | |
| 3 | Materials and Methods | |
| 4 | Results | |
| 5 | Discussion | |
| 6 | Summary | |
| 7 | References | |

**d) Format of the title page**

**Title of Dissertation**

Dissertation submitted in partial fulfillment of the requirement for the degree of Master of Philosophy in Botany to the Alagappa University, Karaikudi -630003.

By
(Student Name)
(Register Number)

University Logo

**Department of Botany**
**Alagappa University**
*(A State University Accredited with "A$^{+}$" grade by NAAC (CGPA: 3.64) in the Third Cycle and*
*Graded as Category-I University by MHRD-UGC, 2019: QS ASIA Rank-216, QS BRICS Rank-104, QS India Rank-20*)

Karaikudi - 630003

(Year)

**e) Format of certificate**

This is to certify that the dissertation entitled _____ submitted in partial fulfillment for the requirement of the Degree of Master of Philosophy in Botany to the Alagappa University, Karaikudi is a bonafide record of research work done by Mr./Miss _____ under my supervision and guidance and that no part of the dissertation has been submitted for the award of degree, diploma, fellowship or other similar titles or prizes and that the work has not been published in part or in full in any scientific journal or magazines.

**f) Dissertation evaluation**

| | | Marks |
|---|---|---|
| Dissertation Work (thesis) | : | 100 |
| Viva -voce | : | 50 |
| Internal Assessment | : | 50 |
| **Total** | **:** | **200** |

**11. The maximum duration for completion of the course**

The maximum period for completion of M. Phil., in Botany shall not exceed eight semesters.

**12. Commencement of regulation**

These regulations shall come into effect from the academic year 2022-2023 for students who are admitted to the first year of the course during the academic year 2022-2023.

**13. Passing minimum**

- ✓ A candidate shall be declared to have passed in each course if he/she secures not less than 40% marks in the End Semester Examinations and 40% marks in the Internal Assessment and not less than 50% in the aggregate, taking Continuous assessment and End Semester Examinations marks together.

- ✓ The candidates not obtained 50% in the Internal Assessment are permitted to improve their Internal Assessment marks in the subsequent semesters (2 chances will be given) by writing the CIA tests and by submitting assignments.

- ✓ Candidates, who have secured the pass marks in the End-Semester Examination and in the CIA but failed to secure the aggregate minimum pass mark (E.S.E + C I.A), are permitted to improve their Internal Assessment mark in the following semester and/or in University examinations.

- ✓ A candidate shall be declared to have passed in the Project Work if he /she get not less than 40% in each of the Project Report and Viva-Voce and not less than 50% in the aggregate of both the marks for Project Report and Viva-Voce.

A candidate who gets less than 50% in the Project Report must resubmit the Project Report. Such candidates need to take again the Viva-Voce on the resubmitted Project. Each student should have taken 60 credits as a core course, Internship course (core) 2, 9 credits as a major elective; 4 credits as non-major elective, 15 credits as dissertation work, in addition, MOOCs courses as extra credits, thus totaling least 90 + extra credits required to complete M.Phil., Botany degree course. Each paper carries 4 /3/ 2 credits.

## 14. Grading of the Courses

The following table gives the marks, Grade points, Letter Grades and classifications meant to indicate the overall academic performance of the candidate.

Conversion of Marks to Grade Points and Letter Grade (Performance in Course / Paper)

| RANGE OF MARKS | GRADE POINTS | LETTER GRADE | DESCRIPTION |
|---|---|---|---|
| 90 - 100 | **9.0 – 10.0** | **O** | **Outstanding** |
| 80 - 89 | **8.0 – 8.9** | **D+** | **Excellent** |
| 75 - 79 | **7.5 – 7.9** | **D** | **Distinction** |
| 70 - 74 | **7.0 – 7.4** | **A+** | **Very Good** |
| 60 - 69 | **6.0 – 6.9** | **A** | **Good** |
| 50 - 59 | **5.0 – 5.9** | **B** | **Average** |
| 00 - 49 | **0.0** | **U** | **Re-appear** |
| ABSENT | **0.0** | **AAA** | **Absent** |

a) Successful candidates passing the examinations and earning GPA between 9.0 and 10.0 and marks from 90 – 100 shall be declared to have Outstanding (O).

b) Successful candidates passing the examinations and earning GPA between 8.0 and 8.9 and marks from 80 - 89 shall be declared to have Excellent (D+).

c) Successful candidates passing the examinations and earning GPA between 7.5 – 7.9 and marks from 75 - 79 shall be declared to have Distinction (D).

d) Successful candidates passing the examinations and earning GPA between 7.0 – 7.4 and marks from 70 - 74 shall be declared to have Very Good (A+).

e) Successful candidates passing the examinations and earning GPA between 6.0 – 6.9 and marks from 60 - 69 shall be declared to have Good (A).

f) Successful candidates passing the examinations and earning GPA between 5.0 – 5.9 and marks from 50 - 59 shall be declared to have Average (B).

g) Candidates earning GPA between 0.0 and marks from 00 - 49 shall be declared to have Re-appear (U).

h) Absence from an examination shall not be taken as an attempt.

From the second semester onwards, the total performance within a semester and continuous performance starting from the first semester are indicated respectively **by Grade Point Average (GPA) and Cumulative Grade Point Average (CGPA).** These two are calculated by the following formulate

**GRADE POINT AVERAGE (GPA)** = $\Sigma_i C_i \; G_i / \Sigma_i C_i$

**GPA** = Sum of the multiplication of Grade Points by the credits of the courses
Sum of the credits of the courses in a Semester

**15. Classification of Final Result**

| CGPA | Grade | Classification of Final Result |
|---|---|---|
| 9.5 – 10.0<br>9.0 and above but below 9.5 | **O+**<br>**O** | First Class – Exemplary* |
| 8.5 and above but below 9.0<br>8.0 and above but below 8.5<br>7.5 and above but below 8.0 | **D++**<br>**D+**<br>**D** | First Class with Distinction* |
| 7.0 and above but below 7.5<br>6.5 and above but below 7.0<br>6.0 and above but below 6.5 | **A++**<br>**A+**<br>**A** | First Class |
| 5.5 and above but below 6.0<br>5.0 and above but below 5.5 | **B+**<br>**B** | Second Class |
| 0.0 and above but below 5.0 | **U** | Re-appear |

The final result of the candidate shall be based only on the CGPA earned by the candidate.

a) Successful candidates passing the examinations and earning CGPA between 9.5 and 10.0 shall be given Letter Grade (O+), those who earned CGPA between 9.0 and 9.4 shall be given Letter Grade (O) and declared to have First Class –Exemplary*.

b) Successful candidates passing the examinations and earning CGPA between 7.5 and 7.9 shall be given Letter Grade (D), those who earned CGPA between 8.0 and 8.4 shall be given Letter Grade (D+), those who earned CGPA between 8.5 and 8.9 shall be given Letter Grade (D++) and declared to have First Class with Distinction*.

c) Successful candidates passing the examinations and earning CGPA between 6.0 and 6.4 shall be given Letter Grade (A), those who earned CGPA between 6.5 and 6.9 shall be given Letter Grade (A+), those who earned CGPA between 7.0 and 7.4 shall be given Letter Grade (A++) and declared to have First Class.

d) Successful candidates passing the examinations and earning CGPA between 5.0 and 5.4 shall be given Letter Grade (B), those who earned CGPA between 5.5 and 5.9 shall be given Letter Grade (B+) and declared to have passed in Second Class.

e) Candidates those who earned CGPA between 0.0 and 4.9 shall be given Letter Grade (U) and declared to have Re-appear.

f) Absence from an examination shall not be taken as an attempt.

**CUMULATIVE GRADE POINT AVERAGE (CGPA)** = $\Sigma_n \Sigma_i C_{ni} G_{ni} / \Sigma_n \Sigma_i C_{ni}$

**CGPA** = Sum of the multiplication of Grade Points by the credits of the entire Programme
Sum of the credits of the courses for the entire Programme

Where '**Ci**' is the Credit earned for Course i in any semester; '**Gi**' is the Grade Point obtained by the student for Course i and 'n' refers to the semester in which such courses were credited.

**CGPA** (Cumulative Grade Point Average) = Average Grade Point of all the Courses passed starting from the first semester to the current semester.

Note: * The candidates who have passed in the first appearance and within the prescribed Semesters of the PG Programme are alone eligible for this classification.

**16. Fee structure**

The following shall be the fee structure for the programme
Tuition Fees per Semester
Laboratory Fees per Semester
Special Fee and other fees shall be as prescribed by the University.

**ALAGAPPA UNIVERSITY, KARAIKUDI**
**M.Phil. BOTANY**

**COURSE STRUCTURE**

| S. No. | Course Code | Name of the course | Credits | Marks | | |
|---|---|---|---|---|---|---|
| | | | | Int. | Ext. | Total |
| **SEMESTER – I** | | | | | | |
| 1. | | **Core Course I** – Research Methodology | 4 | 25 | 75 | 100 |
| 2. | | **Core Course II** – Plant Molecular Biology and Genetic Engineering | 4 | 25 | 75 | 100 |
| 3. | | **Core Course III** – General Skills in Science | 4 | 25 | 75 | 100 |
| **SEMESTER – II** | | | | | | |
| 4. | | **Core Course IV** – Specialization On Research topic | 4 | 25 | 75 | 100 |
| 5. | | **Core Course V** – Dissertation & Viva voce | 8 | 50 | 150 (100 + 50) | 200 |
| | | **TotalMarks** | **24** | **--** | **--** | **600** |

| I-Semester | | | | | |
|---|---|---|---|---|---|
| **Course code** | | **Research Methodology** | **T** | **Credits: 4** | **Hours: 4** |

| | |
|---|---|
| **Objectives** | ➢ To study the characteristic feature Microscopic technique.<br>➢ To study the characteristic feature of Electrophoresis.<br>➢ To learn about various Research methods.<br>➢ To get knowledge on fundamentals in Biostatistics. |
| **Unit-I** | **Microscopy:** Differential interference contrast (DIC), polarization, fluorescent Microscopy, dark field and phase contrast microscopy. Electron microscope – SEM and TEM. Atomic Force Microscopy. Spectrometry: Principle – Beer Lambert's Law – UV, IR, FTIR, Atomic Absorption Spectroscopy, CD, Stop Flow, Mass, MALDI-TOF and NMR. |
| **Unit-II** | **Centrifugation:** Principle and Types of centrifuges, Ultracentrifugation, density gradient centrifugation and continuous centrifugation. Electrophoresis: Principle of Gel electrophoresis, Polyacrylamide gel electrophoresis (PAGE & SDS PAGE) and Agarose gel electrophoresis, comet assay and capillary electrophoresis. Two dimensional electrophoresis and isoelectrofocussing. Chromatography: Principle, Procedures and Application of TLC, PC, Gel Filtration and Ion exchange, Affinity Chromatography, GC, GLC, HPLC/FPLC and HPTLC. |
| **Unit-III** | **Foundations of Research:** Meaning, Objectives, Motivation, Utility, Concept of theory and Characteristics of scientific method, Research Problem Identification and Formulation, Research Question – Investigation Question – Measurement Issues. Hypothesis: Qualities of a good Hypothesis –Null Hypothesis & Alternative Hypothesis. Hypothesis Testing – Logic & Importance. Experimental Design: Concept of Independent & Dependent variables. Scientific Ethics: Ethical issues related to publishing, Plagiarism and Self-Plagiarism. |
| **Unit-IV** | **Biostatistics:** Collection and Presentation of Experimental data, Measures of central tendency - arithmetic mean, median and mode, Measures of dispersion - mean, deviation, standard division and standard error, Correlation and Regression analysis: Biological significance of correlation and regression, Tests of significance: Basis of statistical inference – Students 't-test' for mean, difference of means and test for correlation and regression coefficients – Chi-square test – Analysis of variance and DMRT. Principal component analysis (PCA). Statistical Packages: SPSS and R statistical software. |
| **Unit-V** | **Data collection and analysis:** Web browsing and searching- Electronic biological databases – NCBI, PubMed, Sequence and Structure databases Research publications, Preparation of manuscripts-Review paper, Full paper, Short communications. Thesis writing, Reference Index Card preparation and Proof reading. Data Presentation: Data Preparation – Univariate analysis (frequency tables, bar charts, pie charts, box plots, percentages), Major findings, Conclusions and suggestions. Citation of references and bibliography. |

**Reference and Text Books:**


Gupta, M. & Gupta, D. (2011). *Research Methodology.* New Delhi: PHI Learning Private Ltd.

Gurumani, N. (2006). *Research Methodology for Biological Sciences*. Chennai: MJP publishers.

Kothari, C. R. (2014). *Research Methodology.Methods and Techniques*. New Delhi: New Age Publisher.

Rajshri Tiwari, (2017). *Research Methodology in Botany*. New Delhi: Kumud Publications.

Sharma, B.K (1996). *Instrumental Methods of Chemical Analysis*. Meerut: Goel Publishing House.

Sokal, R.R. and Rohlf, F.J. (1987). *Introduction to Biostatistics (Biology-Statistics Series).* New York: W.H. Freeman & Company.


| | |
|---|---|
| **Outcomes** | ➢ Knowledge about the characteristic feature of Spectrometry.<br>➢ Understanding the Biostatistics.<br>➢ Knowledge on the importance of Electronic biological data. |

| I-Semester | | | | | |
|---|---|---|---|---|---|
| **Course code** | | **Plant Molecular Biology and Genetic Engineering** | **T** | **Credits: 4** | **Hours: 4** |
| **Objectives** | ➢ To study about the Genome Organization in Plants.<br>➢ To study about Protein and expression in Plants.<br>➢ To learn about basis of Genetic engineering. | | | | |
| **Unit-I** | **Plant Genome Organization:** Structural features of a representative plant gene, Chromatin and gene families in plants, Organization of chloroplast and mitochondrial genome, Nucleus encoded and chloroplast encoded genes for chloroplast proteins, Targeting of proteins to mitochondria. | | | | |
| **Unit-II** | **Gene expression and Protein Engineering:** Regulation of prokaryotic and eukaryotic gene expression and gene silencing, Genetic code, protein synthesis – Initiation and their regulation – Elongation and elongation factors, aminoacylation of tRNA, aminoacyl tRNA synthesis, translation, inhibitors, post–translation modification of proteins. | | | | |
| **Unit-III** | **Genetic engineering in plants:** Selectable markers, reporter genes and promoters used in plant vectors, Plant transformation technology – Ti and Ri Plasmids, Mechanism of gene transfer in plants – Direct gene transfer methods – Electroporation, microprojectile bombardment methods, microinjection, Transgenic plants – Drought and salinity tolerance, virus resistance, pest resistance, herbicide resistance, resistance to Fungi and Bacteria. | | | | |
| **Unit-IV** | **Nitrogen Metabolism and Fixation:** Nitrate and ammonium assimilation, amino acid biosynthesis, molecular basis of symbiotic nitrogen fixation by *Rhizobium*. Non–symbiotic (Acetobacter) association and associative (Azospirillum) nitrogen fixation. Phosphate and potassium solubilization and mobilization by microorganisms. Role of arbuscular mycorrhizal fungi on plant growth. | | | | |
| **Unit-V** | **Molecular markers:** RFLP maps, linkage analysis, RAPD markers, microsatellites, SCAR (Sequence Characterized Amplified Regions), SSCP (Single Standard Conformational Polymorphism), AFLP, QTL, map base cloning, Molecular marker assisted selection. | | | | |

**Reference and Text Books:**


Chrispeels, M. J.&Sadava, D. E. (2000). *Plants, Genes and Agriculture*. Canada: Jones and Barlett Publishers.

Lesley Stanley. (2014.) *Molecular and Cellular Toxicology: An Introduction*. UK; Blackwell Publishing.

McCoy, H. (2019). *Plant Genetic Engineering*. Callisto Reference Company.

Plummer, D. T. (1988). *An introduction to practical Biochemistry*. New Delhi: Tata McGraw Hill Pub. Co. Ltd.

Primrose, S.B., Twyman, R.M. & Old, R. W. (2001). *Principles of gene manipulation*. UK: Blackwell Science.

Slater, A., Scott, N. & Fowler, M. (2003). *Plant biotechnology. The genetic manipulation of plants*. Oxford University Press.

Westhoff, P. (1998). *Molecular plant development from gene to plant*. UK: Oxford University Press.

Wilson, A. (2016). *Plant Molecular Biology*. Syrawood Publishing House.


| | |
|---|---|
| **Outcomes** | ➢ Knowledge about the characteristic feature of Molecular markers.<br>➢ Understanding the Plant transformation.<br>➢ Knowledge on the importance of Protein engineering. |

| I-Semester | | | | | |
|---|---|---|---|---|---|
| **Course code** | | **General Skills in Science** | **T** | **Credits: 4** | **Hours: 4** |
| **Objectives** | ➢ To study the New technologies on the methodology of teaching<br>➢ To study C++ programming<br>➢ To learn about the basis of operating system and translators | | | | |
| **Unit-I** | **Introduction to Computers:** Computer Hardware, Input devices and media-magnetic device and media-output devices and media-storage device and media-computer architecture – system software: types, operating system and translators – Application software: types of language – application packages – integrated software – Introduction to operating system – Working with windows and office programs – Internet, Website and E-mail. | | | | |
| **Unit-II** | **Basic Computer operating skills:** Starting a program and opening a document – saving and naming the document – create file and folders – deleting and un-deleting a document – closing a document – renaming and moving a document – finding a document – MS office: Word, Excel, Access, Power point, out look and integrated office applications – C programming – Principles, classes and structure of C++ programming. | | | | |
| **Unit-III** | **Communication skills in English:** Understanding communication – greeting and introducing – making requests – asking for and giving permission – offering help – giving instruction and directions art of small talk participating in conversation – making a short formal speech – Describing the people, place, events and things. Telephone skill: understanding, handling calls, leaving message and making request. Written communication: report writing, note making – career skills: curriculum vita and cover letter – Facing an interview and presentation skills – academic listening. | | | | |
| **Unit-IV** | **Pedagogical skill for science teachers:** Qualification, teacher competencies and professional growth. Theory and models of curriculum development: Concept and Technical scientific models of curriculum development – planning a science library – Handling of practical classes. Educational technology and classroom pedagogy: educational Technology – Concept, Emerging technologies – New technologies on methodology of teaching, learning experiences and curriculum development. Micro-teaching: Meaning, teaching, skill of stimulus variation, questioning, explanation, reacting, linking and benefits. | | | | |
| **Unit-V** | **Preparation of charts and models for handling science classes:** Creating management documents e.g., Curriculum Plan, Time Table scheduling, Evaluation – Strategies etc – Learning to write and draw on the blackboard – Preparation of over head projector presentations – Preparation of power point / LCD presentations – Preparation of micro-teaching skills – Preparation of teaching materials – seminar classes for PG students – Preparation of album. | | | | |
| **Reference and Text Books:**<br>Alan Barker. (2000). *Improve your communication skills*.UK: Kogan page.<br>Chambers,H. E. (2001). *Communication skills for scientific and technical professional*, Perseus: Basic Books.<br>Curtis Frye (2019). *Microsoft office Excel:Step by Step*. UK: Pearson education Inc.<br>Habraken, J. (2003). *Microsoft office 2003. All- in-one*. USA: Que.<br>Hartman, H. J. (2001). *Metacognition in learning and instruction*: *theory, research and practice*. *India*: Springer.<br>Rosenblatt,L. (2010). *Rethinking the Way We Teach Science: The Interplay of Content, Pedagogy and the Nature of Science*: UK: Taylor & Francis. | | | | | |
| **Outcomes** | ➢ Knowledge of Computer operating skills.<br>➢ Understanding the LCD presentations.<br>➢ Knowledge on the importance of pedagogy. | | | | |

**II-Semester**

**Specialization on the researchtopic-Guide paper**

| Course code | | Physiology of Plant Pathology | T | Credits: 4 | Hours: 4 |
|---|---|---|---|---|---|

**Objectives**

- To study about the Plant Disease and their causative agents.
- To study about the Plant Pathogens.
- To learn the basis of Plant Quarantines.

**Unit-I**

**Concepts of plant diseases –** Causes of plant diseases. Types and Symptoms Identification of plant diseases. Host parasite interrelationship and Interactions. Disease control methods – cultural, physical, chemical and biological methods. Legislation and Quarantine measure – eradication – burning – removal of alternate host. Koch's postulate – Environment and Nutrition in disease – development – defense mechanism – Principles of plant disease.

**Unit-II**

**Common Plant Diseases:** Disease caused by Fungi (Blast of Paddy, White rust of Mustard and Rust of Wheat), Bacteria (Blight of Paddy, Black arm of Cotton and Ring rot of Potato), Virus (Bunchy top of Banana, Yellow – vein mosaic disease and Cucumber mosaic). Mycoplasma (Grassy shoot disease of Sugarcane and Little leaf disease).

**Unit-III**

**Effects of Pathogens on Photosynthesis:** Effect of Pathogens on Translocation of Water and Nutrients in the Host Plant: Interference with Upward Translocation of Water and Inorganic Nutrients, Effect on Absorption of Water by Roots, Effect on Translocation of Water through the Xylem, Effect on Transpiration, Interference with the Translocation of Organic Nutrients through the Phloem, Effect of Pathogens on Host Plant Respiration : Respiration of Diseased Plants, Effect of Pathogens on Permeability of Cell Membranes, Effects of Pathogens on Transcription and Translation, Effect of Pathogens on Plant Growth, Effect of Pathogens on Plant Reproduction.

**Unit-IV**

**Mechanism of Pathogen Invasion:** Mechanical Forces Exerted By Pathogens on Host Tissues, Chemical Weapons of Pathogens, Enzymes in Plant Disease, Enzymatic Degradation of Cell Wall Substances, Enzymatic Degradation of Substances Contained in Plant Cells; Proteins; Starch; Lipids, Microbial Toxins in Plant Disease,Toxins That Affect a Wide Range of Host Plants, Growth Regulators in Plant Disease, Detoxification of Low-Molecular Weight Antimicrobial Molecules, Role of Type III Secretion in Bacterial Pathogenesis, Suppressors of Plant Defense Responses, Pathogenicity and Virulence Factors in Viruses and Viroids.

**Unit-V**

**Plant Defence Mechanisms:** Pre-existing Structural and Chemical Defenses, Preexisting Defense Structures, Pre-existing Chemical Defenses, Inhibitors Released by the Plant in Its Environment; Inhibitors Present in Plant Cells before Infection Cell Wall Defense Structures, Histological Defense Structures , Formation of Cork Layers, Abscission Layers, Tyloses, Deposition of Gums, Necrotic Structural Defense Reaction: Defense through the Hypersensitive Response, Induced Biochemical Defenses in: Non-Host Resistance, In Partial, Quantitative (Polygenic, General, or Horizontal) Resistance. Induced Biochemical Defenses in the Hypersensitive Response (R Gene) Resistance. Detoxification of Pathogen Toxins by Plants, Immunization of Plants against Pathogens, Defense through Plantibodies, Systemic Acquired Resistance, Induction by Artificial Inoculation with Microbes or by Treatment with Chemicals, Defense through Genetically Engineering Disease-Resistant Plants, With Plant-Derived Genes, With Pathogen-Derived Genes. Defense through RNA Silencing by Pathogen Derived Genes.

**Reference and Text Books:**


Agrio s, G.N. (2005). *Plant Pathology*. California: Acad. Press, Inc.

Alexopoulos, C.J., Mims, C.W. & Blackwell, M. (1995). *Introductory Mycology.*New Jersey: John Willy and Sons. Inc.

Biswas, S.P. & Biswas, A. (1984). *An Introduction to Viruses*. New Delhi: Vani Education Books.

Clifton, A. (1958). *Introduction to the Bacteria*. New York: McGraw Hill Books Co.

Mehrotra, R.S. &Aneja, K.R. (1990). *An introduction of Mycology*.New Delhi: New Age International Press.

Mehrotra, R.S. &Aggarwal, A. (2003). *Plant Pathology*. New Delhi: Tata McGraw Hill Publ. Ltd.

Pelezar, M. J., Shan, E.C.S. & Krieg, N.R. (1993). *Microbiology*. New Delhi: Tata McGraw Hill Publ.

Ronald M. Atlas (1995). *Principles of Microbiology*. USA: Mosby-Year Book, Inc.

Singh, R.S. (1990). *Plant Disease*. 6th Edition, New Delhi: Oxford, IBH Publ.

Sumbali, G. (2005). The Fungi.New Delhi: Narosa Publ. House.


**Outcomes**

- Knowledge about the Plant Disease.
- Understanding the host-pathogen interaction.
- Knowledge on the importance plant quarantine.

| II-Semester<br>Specialization on the research topic-Guide paper | | | | | |
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| **Course code** | | **Plant- Microbe Interactions** | **T** | **Credits: 4** | **Hours: 4** |
| **Objectives** | ➢ To study about the Plant-Microbe interaction.<br>➢ To study about the Plant Pathogens.<br>➢ To learn about basis of Plant Quarantines. | | | | |
| **Unit-I** | **History and recent developments in Plant pathology:** Nature and concept of plant disease- Causes of disease- various levels of parasitism-importance of plant diseases- Classification of plant diseases- Significance of plant diseases. History of Plant Pathology-Herbalists; Systematics; Modern period of plant pathology. | | | | |
| **Unit-II** | **Types of Plant-Microbe associations:** Interrelation between microbes and plant- Plant-Microbe Interaction; Plant-Microbe-Microbe Interaction; Microbe-Microbe Interaction Interrelationship between microorganisms; Positive (mutualism; protoco-operation; commensalism) and Negative (Competition; Parasitism, Amensalism) interactions. | | | | |
| **Unit-III** | **Pathogenesis and Physiological Changes:** Penetration and entry of plant pathogens- Development inside host tissue- Enzymes and toxins in plant diseases; Enzymes for waxes and cutins, pectic enzymes, macerating enzymes, hemicellulases, lignolytic enzymes, proteolytic enzymes, lipolytic enzymes, inactivation of enzymes- Permeability changes in diseased plants; Effect of plant pathogens on translocation of water and nutrients, photosynthesis, respiration, nitrogen and protein metabolism, phenols, growth regulators, transcription and translation in diseased plants. | | | | |
| **Unit-IV** | **Plant's Defense Mechanisms:** Infection and Genetics of Plant Pathogen interaction, Morphological or structural, biochemical defense mechanisms; defense through induced synthesis of proteins and enzymes, formation of substrates resisting the enzymes of pathogen, detoxification of pathogen toxin, altered respiration, hypersensitive reaction, phytoncides. Genetics of host-parasite interaction; Resistance and susceptibility; common antigen hypothesis; phytoalexin-induced hypothesis; vertical and horizontal resistance; mutation; heterokaryosis; parasexual recombination; adaptation; saltation; cytoplasmic variation; sexual recombination; physiological specialization. | | | | |
| **Unit-V** | **Management of Diseases:** Cultural methods; Chemical methods; Breeding for disease resistance; innovative methods of plant disease control-Application of Biotechnology and plant pathology; tissue culture techniques, selection for disease resistance, *r-DNA* technology, monoclonal antibodies and somaclonal variants. | | | | |
| **Reference and Text Books:**<br>Agrios, G.N. (2005). *Plant Pathology*. California: Acad. Press, Inc.<br>Jeng-Sheng Huang (2009). *Plant Pathogenesis and Resistance: Biochemistry and Physiology of Plants-Microbe Interactions*. Berlin: SpringerVerlag.<br>Matthew Dickinson (2003). *Molecular Plant Pathology*. Garland Science/ Taylor& Francis Group.<br>Mehrotra, R.S. &Aggarwal, A. (2003). *Plant Pathology*. New Delhi: Tata McGraw Hill Publ. Ltd.<br>Singh, R.S. (1990). *Plant Disease*. 6th Edition, New Delhi: Oxford, IBH Publ. | | | | | |
| **Outcomes** | ➢ Knowledge about the Plant Disease.<br>➢ Understanding the host-pathogen interaction.<br>➢ Knowledge on the importance plant quarantine. | | | | |

| II-Semester<br>Specialization on the research topic- Guide paper | | | | | |
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| **Course code** | | **Bioprospecting of Medicinal and Aromatic Plants** | **T** | **Credits: 4** | **Hours: 4** |
| **Objectives** | ➢ To study about the Medicinal and Aromatic Plants.<br>➢ To study about the Cultivation techniques.<br>➢ To learn about basis of Plant Quarantines. | | | | |
| **Unit-I** | **Medicinal and Aromatic Plants:** Scope and importance. Conservation strategies – *in situ* conservation – national parks, sanctuaries, biosphere reserves. *Ex situ* conservation – cryopreservation, synthetic seeds, botanical garden, arboreta, herbal garden and field gene bank. Biodiversity act and Intellectual Property Right in the area of medicinal plants. Ethnobotany: Concept, relevance and classification. Methods and techniques used in ethnobotany. Ethnopharmacology and its applications. | | | | |
| **Unit-II** | **Sources of natural drugs:** Traditional plant medicines as a source of new drugs: Examples of various plants/plant parts/plant products and their form for treatment of different ailments. Pharmacological activities of natural products. Nutraceuticals and cosmaceuticals: General introduction, Classification and their formulations, Botanical sources, properties and uses | | | | |
| **Unit-III** | **Chemotaxonomy:** Chemotaxonomy of higher and lower plants and distribution of certain chemotaxonomical group of constituents in plant kingdom like alkaloids, glycosides and terpenoids. Extraction methods of medicinal and aromatic plants. Selection and purification of solvents for extraction. Classification, chemical nature and tests for carbohydrates, proteins, alkaloids, flavonoids and terpenoids. WHO and AYUSH guidelines for safety monitoring of natural medicine spontaneous reporting schemes for bio-drug adverse reactions; Bio drug-drug and bio drug-food interactions with suitable examples. | | | | |
| **Unit-IV** | **Functional foods and Neutraceuticals:** Definition, Classification, Occurrence and Characteristic features (Chemical nature, medicinal and health benefits) of photochemicals – Carotenoids, Phenolic acids, Flavonoids, Saponins, Anthocyanins and Tocopherols. Free radicals – Biological roles and adverse effects. Antioxidants – Types, Foods containing antioxidant nutraceuticals, antioxidants in medicinal plants. Formulation and standardization of neutraceuticals; Regulatory aspects, FSSAI guidelines; Polyunsaturated fatty acids; Herbs as functional foods. | | | | |
| **Unit-V** | **Post harvest technology in medicinal crops:** scope and importance. Drying processes, garbling, sorting, packing, storage. Avoiding desiccation, decay and microbial contamination and spoilage - Impact of these on drug yield, quality and action. Adulteration with reference to plant drugs, type of adulterants and method of adulteration. Quality control of crude drugs. Importance of herbal marketing. Regulatory requirements for new drugs: Markers constituents-Definition, importance in crude drug standardization. Examples of Biomarkers. Standardization, quality, efficacy and safety requirements & assessment procedures for herbal medicines as per USFDA. | | | | |

**Reference and Text Books:**


Evans, W. C. (2009). *Trease and Evans Pharmacognosy*. London: BailliereTindall.

Himadri Panda (2017). *Herbal and Aromatic Plants.* New Delhi: Discovery publishing house.

Kumar, N. (2017).*Introduction to spices, plantation crops, medicinal and aromatic plants.*New Delhi: Oxford and IBH publishing Company.

Mukherjee P. K. (2002). *Quality Control of Herbal Drugs*. New Delhi: Business Horizons Pharmaceutical Publisher.

Rasheeduz Zafar (2017). *Medicinal plants of India.* New Delhi: CBS Publishers & Distributors.

Schirmer, R.E. (2000). *Modern Methods of Pharmaceutical Analysis.* Vol. 1, 2, Boca Raton F.L: CRC Press.

Verapoorte, R and H.W. Alferman (2003). *Metabolic engineering of plant secondary metabolites.* Netherlands: Kluwar Academic Publ.


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| **Outcomes** | ➢ Knowledge about Medicinal Plants.<br>➢ Know about harvest technology.<br>➢ Knowledge of herbal medicine. |

## SCIENCE CAMPUS