School of Sciences

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M.Sc. (BOTANY)

Programme Code: 0902BY

(2 YEARS FULL TIME POST GRADUATE COURSE)

SEMESTER PATTERN

(2024)

Syllabus M.Sc. BOTANY (Prog Code: 0902BY)

GENERAL INTRODUCTION OF THE DEPARTMENT

MATS School Sciences (MSS) was established with a vision to create technocrats in the applied branches of Biological and Chemical Sciences to convey updated scientific knowledge. In the school the performances of the students are constantly monitored by continuous assessment. The School believes in supplementing academic input of students with the help of regular Seminar, Guest Lectures, Industrial/Research Institute visits and encouraging the students to participate in National & International Seminars, Conferences and Workshops.

DEPARTMENT HIGHLIGHTS

- Research focus on frontier of Life Sciences and affordable healthcare
- Highly acclaimed scientists as faculty
- State-of-the-art Lab facilities
- Hand-on training on sophisticated equipments
- Academia – Industry interface
- Multidisciplinary research in affordable health care, Agriculture and Food

COURSE DESIGN

The department follows a unique course-design which is contemporary and cutting-edge. It includes modern and advanced papers/subjects including the papers from Management/Science as given in the curriculum matrix

PEDAGOGY

- Chalk Board, LCD and Projector based teaching
- Research based teaching
- Project based learning
- Separate lab bench for each student

FACILITIES

State-of-the-art facilities include:

- Double beam UV- Visible Spectrophotometer, Cooling Centrifuge, Microfuge, Incubators, Microscopes, Laminar flow hoods, Colorimeter, Micro- and regular balance, Electronic Balance Autoclave, Glass distillation apparatus, Computers, Deep freeze, DNA/RNA & Protein Electrophoresis apparatus, Plant Tissue Culture racks with light arrangements, Shakers, BOD incubator & Orbital Shaking Incubator etc.
- Microbial cell culture
- Microtome
- Various Botanical Specimens
- Various Permanent Slides
- Conservation Biology Lab

FACULTIES

- Well experienced faculties from Academic Institutes and Industries
- Invited lectures by eminent scientists from different countries

M.Sc. Botany: SCOPE AND CONTENT

Botany is the study of plant sciences and is also known as plant biology or phytology. Students take up Master of Science (M.Sc) in Botany if they are interested to pursue a career in plant life and its characteristics. An M.Sc Botany course is a two-year course and various universities and colleges offer M.Sc Botany. The course is designed in such a manner that students can become Botanists, mycologists and phycologists.

Botany also deals with various aspects of agriculture, horticulture, forestry and environmental science. The study of plants is vital as life is dependent on plants for a living. Plants produce energy, carbon, oxygen, nitrogen and water.

OBJECTIVES OF THE M.Sc. Botany PROGRAM

1. To impart knowledge and skills in various aspects of Botany.
2. To train the students for industrial need and to pursue further education.
3. To develop human resource and entrepreneurs in Botany with the ability to independently start their own ventures or small biotech units in the field of Botany.
4. Understand modern Botany - practices and approaches with an emphasis in technology application in pharmaceutical, medical, industrial, environmental and agricultural areas.
5. Become familiar with public policy, bio-safety, and intellectual property rights issues related to Botany applications nationally and globally
6. Gain experience with standard molecular tools and approaches utilized: to manipulate genes, gene products and organisms.
7. Develop skills in international teamwork and research collaboration.

ELIGIBILITY FOR ADMISSION:

Interested aspirants for M.Sc. Botany degree need to fulfill the below mentioned minimum eligibility criteria.

- Completion of UG (10+2+3) level of education.
- Botany as one of the subjects at UG level

Instead of biology, one may even have had any subject related to biological sciences as one of the main subject of study.

PROGRAM OUTCOME:

1. Postgraduates will be able to apply knowledge, concepts to solve issues related to their course.
2. Postgraduates will have ability to identify problems related to their subjects.
3. Postgraduates will have ability to analyze and derive valid conclusions with fundamental knowledge in their respective subjects.
4. Post graduates upon the needs of the environment and society, will be able to fulfill the same in the form of solutions within the safety limit of prevalent rules and guidelines.
5. Postgraduates will have ability to design, conduct experiments, analyze and interpret data for investigating problems in their respective fields.
6. Postgraduates will have the ability to select and apply appropriate tools and techniques.
7. Postgraduates will have knowledge for assessing societal, health, safety and legal aspects and the duties as responsible citizens of the country.
8. Postgraduates will have the knowledge of the need for sustainable development.
9. Postgraduates will have the knowledge of ethics and regulatory norms of their respective course.
10. Postgraduates will have oral, written communication skill along with team spirit.

PROGRAM SPECIFIC OUTCOMES:

1. Acquire knowledge on the various aspects of life sciences, cell biology, genetics, taxonomy, physiology, applied BYany.
2. Identify classify the plants by using the key characters.
3. Prepare and view specimens for examination using light microscopy.
4. Use pure culture and selective techniques to isolate fungi, plant pathogens, algae and identify them.
5. Qualitative and quantitative estimate the number of floral components by using enumeration and suitable sampling and techniques.
6. Use appropriate plant molecular techniques and use of instrumentation related to it.
7. Practice safe laboratory procedures, using appropriate protective, biosafety and emergency procedures.
8. Documentation and report writing on experimental protocols, results and conclusions, study tours and filed

visits etc.

CAREER PROSPECTS:

A career in Botany might just be one of the most preferred careers in India. Botany as a subject is related to the study of plants and a career in it would mean studying in depth about fungi, algae, plants, diseases, growth, metabolism and the structure between different groups. When planning a career in Botany, the job profile can include study of plants, research, working with industries, teaching, self employment, and being a part of many more fields.

A person who works in this field is called a Botanist. It will be the job of the Botanist to study plant life along with finding solutions to problems related to that of forest and agriculture. There are also Botanists who deal with space travel, agriculture, artificial environments, hydroponics and various other interesting areas of research.

Botanists are required by varying organizations ranging from multinationals to research organizations to hospitality and tourism bodies, depending upon the nature of their activities. They fit into different roles depending on the activity of the organization and evolve into senior positions at high salaries.

THE MAIN JOB SECTORS ARE AS FOLLOWS:

After the completion of M.Sc in Botany, you can work in public and government sector as well. You can get a job role of Plant Taxonomy, Weed Scientists, Ethnobiology, Plant Scientists, Pathology, Palynology, Plant ecology and much more. You can make a career in different companies such as Chemical Companies, Nurseries, Seed Companies, Biotechnology Firms, Fruit Growers, Food Companies, Oil Industry and much more.

ATTENDANCE:

A candidate shall be deemed to have undergone a regular course of study in the University, if he/sh e has attended at least 60% of the lectures in each subject will be at least 75% in the aggregate of lectures, tutorials and practical in order to be eligible to appear in the Final Examination.

SCHEME OF EXAMINATION, EVALUATION AND DISTRIBUTION OF MARKS

1 The overall weightage of a course in the Syllabi and Scheme of Teaching & Examination shall be determined in terms of Marks assigned to the course.

2 The evaluation of students in a course shall have two components unless specifically stated otherwise in the Scheme of Teaching & Examination and Syllabi:

(i) Evaluation through a semester-end examination (University Examination Marks)

(ii) Continuous evaluation by the teacher(s) of the course.

3 Continuous Evaluation (Internal Marks)

i) Theory courses

The division of internal marks will of 50% marks for the mid semester examination and 50% of marks for the internal class tests. There shall be three class tests held during each semester. The three class tests shall ordinarily be held after 4 weeks, 8 week s and 12 weeks of teaching in accordance with the University Academic Calendar.

(ii) Practical/Laboratory courses

The total internal marks in practical/Laboratory courses shall be based on performance in the laboratory, regularity, practical exercises /assignments, quizzes, etc. The assessment shall be given at three nearly equi-spaced intervals.

Evaluation through a semester-end examination

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The distribution of weightage for various components of the evaluation shall be as given below:

	Bachelor's degree/ Under-graduate diploma	Master's degree/ Post-graduate diploma
A. THEORY COURSES (i) Semester-end examination	70%	70%
(ii) Continuous evaluation by the teachers	30%	30%
B. PRACTICAL/LABORATORY COURSES		
(i) Semester-end examination	70%	70%
(ii) Continuous evaluation by the teachers	30%	30%
C. DISSERTATION/THESIS		
(i) Assessment by External Examiner	70%	70%
(ii) Assessment by Internal Examiner	30%	30%

PASSING MARKS:
For postgraduate students, obtaining a minimum of 45% marks in aggregate in each course shall be essential for passing the course and earning its assigned credits. A candidate, who secures less than 45% of marks in a course, shall be deemed to have failed in that course.

GRADING SYSTEM:

For UG:

80% and above – "10 Grade Point" and Letter Grade "O" (Outstanding)

40% and above but below 45% - "Grade Point 4" and Letter Grade "P" (Pass)

For PG:

80% and above – "10 Grade Point" and Letter Grade "O" (Outstanding) 45% and above but below 50% - "Grade Point 4" and Letter Grade "P" (Pass)

PROGRAM DURATION:
The maximum permissible period for completing a program for which the prescribed program duration is **n semesters**, shall be **(n+2)** semesters. All the program requirements shall have to be completed in (**n+2**) semesters.

ATKT criteria:
ATKT Candidate means a candidate who failed in not more than forty percent of the total number of Core and Core bracket papers, excluding the Practical Examination/Project Work/Viva Voce Examination in the Semester Examination and is appearing in the Examination same semester again which is organized with the next Semester Examination. Forty percent (of the total number of Core and Core bracket papers) will be rounded off to higher side in case it is not a whole number. In case a Students fails or was absent in Practical Examination /Project Work/Viva Voce Examination, he/she may be allowed to have an ATKT exam on his/her own expenses

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First Semester

Curriculum Matrix M.Sc. Botany (Prog. Code 0902BY)

Semester					Marks Distribution		
Subject Type	**Subject Code**	**Name of Subject**	**Hours/ week**	**Credit (L+T+P)**	**External**	**Internal**	**Total**
Core Course	0902BY1101	Cell Biology and Biochemistry	4	4 (4+0+0)	70	30	100
	0902BY1102	Algae, Bryophytes and Pteridophytes	4	4 (4+0+0)	70	30	100
	0902BY1103	Diversity and Biology of Gymnosperms and Anatomy of Angiosperms	4	4 (4+0+0)	70	30	100
	0902BY1104	Tools and Techniques in Plant biology	4	4 (4+0+0)	70	30	100
Laboratory	0902BY1205	LAB I : Cell Biology and Biochemistry	4	2 (0+0+2)	35	15	50
	0902BY1206	LAB II: Algae, Bryophytes and Pteridophytes	4	2 (0+0+2)	35	15	50
Open Elective	0902OE1307 OR 0902OE1308	Food and Nutrition (0902OE1307) OR Management in Practice (0902OE1308)	4	4 (4+0+0)	70	30	100
		Total	**28**	**24 (20+0+4)**	**420**	**180**	**600**

Second Semester

Curriculum Matrix M.Sc. Botany (Prog. Code 0902BY)

Semester II					Marks Distribution		
Subject Type	**Subject Code**	**Name of Subject**	**Hours/ week**	**Credit (L+T+P)**	**External**	**Internal**	**Total**
Core Course	0902BY2101	Computational Biology	4	4 (4+0+0)	70	30	100
	0902BY2102	Ecology and Environment	4	4 (4+0+0)	70	30	100
	0902BY2103	Plant Physiology and Metabolism	4	4 (4+0+0)	70	30	100
	0902BY2104	Floral Morphology and Embryology of Angiosperms	4	4 (4+0+0)	70	30	100
Laboratory	0902BY2205	Lab III: Computational Biology	4	2 (0+0+2)	35	15	50
	0902BY2206	Lab IV: Ecology and Environment	4	2 (0+0+2)	35	15	50
Open Elective	0902OE2307 OR 0902OE2308	Economic Botany (0902OE2307) OR Nano-Science (0902OE2308)	4	4 (4+0+0)	70	30	100
		Total	**28**	**24 (20+0+4)**	**420**	**180**	**600**

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Third Semester

Curriculum Matrix M.Sc. Botany (Prog. Code 0902BY)							
Semester III					Marks Distribution		
Subject Type	**Subject Code**	**Name of Subject**	**Hours/ week**	**Credit (L+T+P)**	**External**	**Internal**	**Total**
Core Course	0902BY3101	Microbial Diversity	4	4 (4+0+0)	70	30	100
	0902BY3102	Genetics and Breeding	4	4 (4+0+0)	70	30	100
	0902BY3103	Plant Pathology	4	4 (4+0+0)	70	30	100
	0902BY3104	Angiosperms Taxonomy and Phytogeography	4	4 (4+0+0)	70	30	100
Laboratory	0902BY3205	Lab V: Microbial Diversity	4	2 (0+0+2)	35	15	50
	0902BY3206	Lab VI: Genetics and Breeding	4	2 (0+0+2)	35	15	50
Open Elective	0902OE3307 OR 0902OE3308	Medicinal and Pharmaceutical Science (0902OE3307) OR Environmental Biotechnology (0902OE3308)	4	4 (4+0+0)	70	30	100
		Total	**28**	**24 (20+0+4)**	**420**	**180**	**600**

Fourth Semester

Curriculum Matrix M.Sc. Botany (Prog. Code 0902BY)							
Semester IV					Marks Distribution		
Subject Type	**Subject Code**	**Name of Subject**	**Hours/ week**	**Credit (L+T+P)**	**External**	**Internal**	**Total**
Core Course	0902BY4101	Plant Molecular Biology: Genetic Engineering	4	4 (4+0+0)	70	30	100
	0902BY4102	Plant Resource Utilization and Conservation	4	4 (4+0+0)	70	30	100
	0902BY4103	Dissertation	6	6(6+0+0)	150	50	200
Laboratory	0902BY4204	LAB VII: Plant Molecular Biology: Genetic Engineering	4	2 (0+0+2)	35	15	50
	0902BY4205	LAB VIII: Plant Resource Utilization and Conservation	4	2 (0+0+2)	35	15	50
Open Elective	0902OE4306 OR 0902OE4307	Water Pollution Management (0902OE4306) OR Air Pollution and Climate Change (0902OE4307)	4	4 (4+0+0)	70	30	100
		Total	**26**	**22 (18+0+4)**	**430**	**170**	**600**

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SEMESTER I

CELL BIOLOGY AND BIOCHEMISTRY

Code: 0902BY1101

Credit: 4

Course Objectives: **Total: 100 (70+30)**

1. To impart in-depth knowledge of biochemistry.
2. To train the students to pursue further education.
3. Become familiar with biochemical tools.

Course Outcome:

Skills that students obtain after completion of the course:

1. Understanding of the fundamentals Biochemistry and key principles of Biochemistry.
2. Awareness of the major issue at the forefront of the discipline.
3. Good quantitative skills such as the ability to accurately and reproducibly prepare reagents for experiments.
4. Ability to dissect a problem in to its key features.

UNIT: I Structural organization of typical plant cell. Plant Cell wall biogenesis and structure, Plasma membrane, Structure and function of different cell organelles in cell, Structural organization of chloroplast and mitochondria. Nuclear envelope, nuclear pore complex, their ultra-structural model, Nucleolus: structure and function.

UNIT: II Central dogma: replication of DNA, semi-conservative mode of replication, DNA polymerases and DNA synthesis invitro, transcription and translation in prokaryotic and eukaryotic cells, regulation of gene expression in prokaryotes.

UNIT: III Cell-Cell Interaction and signalling: Signalling molecules and mechanism of signalling, secondary messenger, Ca^{+2}, c-AMP, MAP kinase, Basic concepts of Cell division and cell cycle and Regulation.

UNIT: IV Structure and function of carbohydrates, Amino acid, Classification of amino acid, chemical and physical properties of amino acids, reactions of amino acids, peptides and peptide bond, Proteins types and functions, structural features of proteins including primary, secondary and tertiary structure; Lipids: synthesis of saturated and unsaturated fatty acids, oxidation of fatty acids.

UNIT:V Enzyme: definition and characteristics, Enzyme specificity, Enzyme inhibition, Nomenclature of enzymes, coenzyme and cofactors, factors affecting enzyme action, enzyme kinetics, Concepts of Km and Vmax, Michaelis-Menten equation of enzyme kinetics, Ribozyme.

List of Recommended Books:

1. Alberts B. Johnson, A. Lewis, J. Raff, M. Roberts, K. Walter, P. 2008. Molecular Biology of the Cell. Garland Science Publisher. USA.
2. Berg, JM; Stryer L.2010. Biochemistry, W.H. Freeman; Seventh Edition.
3. DeRobertis and DeRobertis. 2010. Cell and Molecular Biology: Saunders College Publisher. UK.

4. Lewin Benzamin 2011.GeneX: Jones and Bartlett Learning Publisher. USA.
5. Lodish and Baltimore 2005.MolecularCellBiology:W H Freeman Publisher.UK.
6. Nelson and Cox. 2002. Lehninger Principle of Biochemistry: 3rd Edition: WH Freeman Publisher.UK.

ALGAE, BRYOPHYTES AND PTERIDOPHYTES

Code: 0902BY1102 **Credit:4**

Total Marks: 100 (70+30)

Course Objectives

1. To impart basic knowledge of plant diversity.
2. To train the students to pursue further education.
3. Become familiar with bioscience tools.

Course Outcome:

The skills that students obtain after completion of the course:

1. Understanding of the fundamentals Plant Diversity and key principles of it.
2. Awareness of the major issue at the fore front of the discipline.
3. Good quantitative skill such as the ability to accurately and reproducibly prepare reagents for experiments.
4. Ability to dissect a problem into it's key features

UNIT: I General characters, classification and current trends in classification of algae, habitats, habit and thallus organization, reproduction and life cycle in algae, evolutionary trends in algae, economic importance algae.

UNIT: II Comparative account of cell structure, thallus organization, reproduction and life cycle of Cyanophyta, Chlorophyta, Phaeophyta, Rhodophyta, Bacillariophyta.

UNIT: III Generalcharacters, classification, origin of Bryophytes, Comparative account of gametophyte and sporophyte of Hepaticopsida, Bryopsida and Anthocerotopsida, Fossil bryophytes, economic importance of bryophytes.

UNIT: IV General characters and classification of Pteridophytes, Heterospory and seed habit, Evolution of sorus, Economic importance of Pteridophytes.

UNIT:V Comparative morphology and anatomy of vegetative and reproductive structure of sporophyte and gametophyte of Psilopsida, Lycopsida, Sphenopsida, Filicopsida.

List of recommended books:

1. Bold and Wynne. 1985. Introduction to the Algae. Prentice Hall Publication. Mumbai.

2. Chapman, V.J. and Chapman D.J. 1973. The Algae. Macmill on and Company, New York.

3. Hoek, Christian et al. 1995. Alage: An Introduction to Phycology. Cambridge University Press. New Delhi.

4. Lee, R.E. 2009. Phycology. Cambridge University Press. New Delhi.

5. Parihar N.S. 1991. Bryophyta. Central Book Depot, Allahabad.

6. Parihar N. S. 1959.

An Introduction to Pteridophyta. Central Book Depot, Allahabad.

7. Rashid A. 2011. An Introduction to Pteridophyta.Vikas Publishing House. New Delhi.

8. Rashid A. 2009. An Introduction to Bryophyta.Vikas Publishing house. New Delhi.

9. Round F.E. 1984. The Ecology of algae. Cambridge University Press. New Delhi.

10. Sharma, O.P. 2006. Textbook of Algae. Tata Mc GrawHill, New Delhi.

DIVERSITY AND BIOLOGY OF GYMNOSPERMS AND ANATOMY OF ANGIOSPERMS

Code: 0902BY1103

Credit:4

Total Marks: 100 (70+30)

Course Objectives:

1. To impart basic knowledge of plant diversity.
2. To train the students to pursue further education.
3. Become familiar with bioscience tools.

Course Outcome:

The skills that students obtain after completion of the course:

1. Understanding the fundamentals Plant Diversity and key principles of it.
2. Awareness of the major issue at the fore front of the discipline.
3. Good quantitative skill such as the ability to accurately and reproducibly prepare reagents for experiments.
4. Ability to dissect a problem into it's key features

UNIT: I Classification of Gymnosperms, Types of fossils and the Process of Fossilization, techniques for studying plant fossils, Brief account of the order Pteridospermales general account of Cordaitales and Pentoxylatles.

UNIT: II General characteristics of gymnosperms, general account of structure, reproduction and affinities of order Ephedrales, Gnetales and Welwitschiales and Genetales, Distribution of living Gymnosperms in India, Economic importance of Gymnosperms.

UNIT: III Shoot apical meristem, Root apical meristem, Control of cell and tissue differentiation especially xylem and phloem, secretory ducts and laticifers, wood development in relation to environmental factors.

UNIT: IV Types and phylogeny of stomata, types of nodal anatomy, phylogenetic and evolutionary consideration of nodal anatomy, types of cambium, factors influencing the growth of cambium, experimental control of cambial activity.

UNIT: V Seed anatomy of Monocotyledonous and Dicotyledonous, special features of seeds or seed appendages, seed germination seedling growth, hormonal control of seedling growth.

List of Recommended Books:

1. Andrews, H.N. 1961. Studies in Palaeobotany. John Wiley. UK.
2. Arnold, C.A. 1974. An Introduction to paleobotany. MC GrawHill. UK.
3. Bhatnagar, S.P. and Moitra A.1996 The Gymnosperms. New Age International Pvt. Ltd. New Delhi.
4. Biswas C. and Johri B.M. 1997. The Gymnosperms. Narosa Publishing House, Delhi
5. Buvat, R. 1988. Ontogeny, Cell differentiation and structure of vascular plants. Springer-Verlag. USA.
6. Chamberlain, C.J. 1935. Gymnosperms-Structure and Evölution. Univ. of Chicago Press. USA.
7. Essau, K.1972. Plant Anatomy. John Willey. UK.
8. Raghavan. V. 1999. Developmental Biology of flowering plants. Springer. Verlag. New Delhi.

TOOLS AND TECHNIQUES IN PLANT BIOLOGY

Code: 0902BY1104

Credit: 4

Course Objectives **Total: 100 (70+30)**

1. To impart in-depth knowledge of instrumentation.
2. Become familiar with working principle of different instruments.
3. To increase expertise of the course.

Course Outcome:

Skills that students obtain after completion of the course:

1. Understanding of the fundamentals instrumentation and key principles of it.
2. Awareness of the major issue at the forefront of the discipline.
3. Good quantitative skills such as the ability to accurately and reproducibly prepare reagents for experiments.
4. Ability to dissect a problem in to its key features.

UNIT I

Centrifugation techniques: Basic Principles of Sedimentation.
Centrifuge and Rotor: Types, Instrumentation and Applications.
Microscopy: Principles of Microscopy; Types: Bright field, Dark field, Phase contrast, Confocal and Fluorescent, Electron Microscopes (SEM and TEM).

UNIT II

Chromatography Techniques: Basic Principles, Instrumentation and Applications;
Plane Chromatography: Paper and Thin Layer Chromatography (TLC).
Column chromatography: Adsorption, Partition, Gel filtration, Ion exchange, Affinity chromatography, High Performance Liquid chromatography (HPLC).

UNIT III

Electrophoretic Techniques: Theory, Instrumentation and Applications;
Types: Paper, Gel electrophoresis and its types, Isoelectric Focusing, Isolation and purification of plasmid, DNA, RNA, proteins;
Blotting: Principles & types of blotting techniques, Southern, Northern, Western, Immunoblotting and Dot blots. FISH, microarray, DNA sequencing.

UNIT IV

Spectrophotometric Techniques: - Basic principles; Lambert Beer's Law, Absorbance, Transmittance and Extinction Coefficient.

UV, Visible and Infrared Spectroscopy: Theory, Instrumentation and Applications;

UNIT V

Principles: Laminar Air flow, Autoclave, Incubator, Hot Air Oven. Media preparation and sterilization. Inoculation and growth monitoring.

Essay: Chemical essay, Biological essay in vivo and in vitro, Principle of cytological and cytochemical techniques.

Fixation: Chemical basis of fixation by formaldehyde, glutaraldehyde, chromium salts, mercury salts, osmium salts, alcohol and acetone, Chemical basis of staining of carbohydrates, protein, lipids, and nucleic acid.

List of Recommended Books:

1. Karp, G. 2009. Cell and Molecular Biology Concepts and Experiments. Willey Publication. UK.
2. Nelson and Cox. 2002. Lehninger Principle of Biochemistry: 3rd Edition: WH Freeman Publisher. UK.
3. Primrose and Twyman, 2009. Principles of Gene manipulation and Genomics, Wiley-Blackwell Publishing. UK.
4. Sambrook and Russell. 2001. Molecular Cloning. 3rd Edn. CSHL Press.USA.
5. Senger, Gupta and Sharma. 2010. Laboratory manual on Biotechnology. WH Publishers. UK.
6. Singh, B.D. 2008. Biotechnology. Narosa Publishing. New Delhi

LAB COURSE I: Cell Biology and Biochemistry
Code: 0902BY1205

Credit: 2
Total Marks: 50 (35+15)

1. Microscopic study of plant cell.
2. Estimation of proteins by spectrophotometric methods.
3. Estimation of carbohydrates by spectrophotometric method.
4. Isolation of plasmid from the bacteria.
5. Isolation of DNA from plant sample and their spectrophotometric quantification.
6. Restriction digestion of the plasmid.
7. Amplification of plant DNA using Polymerase Chain Reaction.
8. Electrophoretic separation and visualization of the DNA/PCR product.
9. Isolation of RNA from Plant sample.
10. c-DNA synthesis.

LAB COURSE II: Algae Bryophytes and Pteridophytes
Code: 0902BY1206

Total Marks: 50 (35+15)

1. Preparation of temporary slide of algal specimen and their identification
2. Isolation and identification of local algal flora.
3. Micro-preparation of different members of Bryophytes.
4. Study of Bryophytes in their natural habitats.
5.
6.

5. Study of habit, anatomy and reproductive structures of Pteridophytes.

FOOD AND NUTRITION (0902OE1307)

Credit: 4
Total Marks: 100 (70+30)

Course Objectives:
1. To impart basic knowledge of Food and Nutrition.
2. To train the students to pursue further education.
3. To be familiar with dietetics and nutritional requirements.

Course Outcome:
Skills that students obtain after completion of the course:
1. Understanding of the fundamentals Food and Nutrition and key principles of it.
2. Awareness of the major issue at the forefront of the discipline.
3. Ability to dissect a problem in to its key features.

UNIT I
Cereal: Types, Structure and composition, Nutritional value, Storage and Care.
Pulses: Types, Composition and Nutritional Value.
Nuts and Oil seeds: Classification, Nutritional value and Importance.

UNIT II
Milk and Milk Products: Composition of Milk, Properties, Effect of Heat and Nutritional value.
Fruits and Vegetables: Composition, Classifications, Nutritional value and Storage.
Flesh Foods: Meat, Fish and Poultry uses, Nutritional value and Storage.

UNIT III
Nutrition: Food as Nutrients, Types of Nutrients, Functions of Food.
Carbohydrates: Classification, Source and Functions.
Fats and Oils: Classification, Source and Functions.
Protein: Sources, Functions, Essential and Non-essential Amino acids.

UNIT IV
Vitamins: Definition, Types, Source, Functions and Deficiency.
Minerals: Source, Functions and Deficiency.
Balance Diet: Definition, Composition, Balance Diet for Adult Man, Woman and Young Children.
RDA: Definition, RDA for Average Indians.

UNIT V
Energy: Definition, Unit of Energy, Body's need for Energy, BMR
Malnutrition: Protein-Energy Malnutrition, Malnutrition and Infection, Malnutrition and Behaviour.
Nutrition and Fitness: Diet and Aerobic Fitness, Fitness Plan.
Nutrition and Disease: Obesity, Diabetes and Heart Disease.

List of Recommended Books
1. Food and Nutrition: Don Ross; Oxford Book Company.
2. Nutritional Biochemistry: Tom Brody; Academic Press.




3. Nutrition Now: Judith E Brown; Wadsworth Cengage Learning.
4. A Text Book of Foods, Nutrition & Dietetics: M R Begum; Sterling Publishers Pvt. Ltd.
5. Nutrition and Dietetics: Subhangini A Joshi; Tata McGraw Hill Education Pvt. Ltd.

MANAGEMENT IN PRACTICE (0902OE1308)

Credit: 4
Total Marks: 100 (70+30)

Course Objectives:
1. To understand the basic functions of management.
2. To know the basic qualities of a manager so that they can be utilized in practical situation.
3. To develop understanding of basic know-how of industrial planning, market assessment, future projections, etc.

Course Outcome:
Skills that students obtain after completion of the course:
1. To prepare business plan and its execution according to market available.
2. Ability to dissect a problem in to its key features.
3. Apply the basic concepts of management to different situations.

UNIT I
Introduction to Management: - Meaning, nature and importance. Evolution of Management-Classical, Neo-classical, Scientific Theory, Administrative Theory; Functions of a Manager. Qualities of a manager. Social Responsibilities of a Manager, Management as a Process-Planning-Meaning and Importance. Organizing-Meaning and Importance. Staffing- Meaning and Importance. Directing – Meaning and Function.

UNIT II
Human Resource Management-Meaning. Importance of Human Resource management. Manpower Planning- Meaning and Importance. Difference between Human Resource Development and Human Resource Planning. Recruitment-Meaning and Importance. Selection- Meaning and Methods Training Meaning. and Types. Performance Appraisal- Meaning and Types.

UNIT III
Organization Behavior- Introduction to Organization Behavior- Meaning, Importance and scope. Motivation- Meaning, Process and Importance. Motivational Theories- Maslow, Herzberg and McClelland. Attitude- Meaning and Importance, Components of attitude in Organization Behavior.
Perception- Meaning and Importance in the context of Organization Behavior.

UNIT IV
Marketing Management- Meaning, Importance and Implications. Marketing Mix- Product- Meaning, types and Importance. Place- Meaning and Importance. Price- Meaning. Methods and Importance; Promotion-meaning. Instruments and Importance to make a marketing decision.

UNIT V
Financial Management- Meaning and Importance. Relationship with other managerial functions. Financial Analysis- Meaning and Importance; Tools of financial management, Fund Flow – Meaning, Process; Fixed and Working Capital- Meaning and Importance.

List of Recommended Books

1. Principles of Management: L. M. Prasad
2. Management by Robbins.
3. Marketing Management-Raja Gopal.
4. Financial Management for Non-Finance Executives by Dr. Prasanna Chandra
5. Human Resource Management by C. V. Mamoria
6. Organizational Behavior by S. Robbins
7. Management by Stoner
8. Financial Management by Khan and Jain
9. Financial Management by Dr. Prasanna Chandra
10. Marketing Management by Philip. A. Kotler
11. Human Resource Management by Edward Flipo

SEMESTER II

COMPUTATIONAL BIOLOGY

Code: 0902BY2101

Credit 4

Total Marks: 100 (70+30)

Course Objectives:

1. To impart basic knowledge of computational biology & bioinformatics.
2. To be familiar with Computational biology and bioinformatics.
3. To have experience of virtual world.

Course Outcome:

Skills that students obtain after completion of the course:

1. Understanding of the fundamentals of Computer and key principles of it.
2. Awareness of its major application.
3. Ability to use Computer for biological applications or related problems.

UNIT: I Scope of Biostatistics, variables in biology, collection, classification, tabulation of data. Frequency distribution, Diagrammatic and graphical presentation of statistical data, Sampling techniques. Measures of central location and dispersion, Simple measure of skewness and Kurtosis, Probability, conditional probability.

UNIT: II Binomial, Poisson and Normal Distribution Correlation and Regression, Least Square method of fitting, Standard error of estimate, Correlation and regression coefficient. Basic idea of significance testing, level of significance, student's 't' test, χ^2(chi-square) test and F-test, Analysis of variance.

UNIT: III Biological databases, EMBL, DDBJ, TAIR, KEGG, Swis prot, Optimal Pair wise Alignment-Biological Sequences and the Exact String-Matching Problem-Fast Alignments: Genome Comparisons and Database Searches.

UNIT: IV Multiple Sequence Alignment- Sequence Profiles and Hidden Markov Models.-Gene Prediction- Phylogeny- Sequence Variation and Molecular Evolution

UNIT: V Testing Evolutionary Hypotheses, In silico analysis of phylogeny, construction of phylogenetic tree, dendrogram, Computational phylogenetics, Construction of QTL mapping, Microarray data analysis.

List of Recommended Books:

1. Arthur, M. 2002. Introduction to Bioinformatics. Oxford University Press. New Delhi Bernard,
2. A. Rosner, 2006. Fundamentals of Biostatics. Thompson Publication Canada.
3. Khan and Khanam. 2003. Fundamental of Biostatistics. Ukaaz Publications. Hyderabad.

4. Krawetz. 2003. Introduction to Bioinformatics: A theoretical and Practical Approach. Humana Press.USA.
5. Miguel and Rade. 2003. Bioinformatics and Genome. Horizon Scientific Press. Utah. USA.

ECOLOGY AND ENVIRONMENT

Code: 0902BY2102

Credit: 4
Total Marks: 100 (70+30)

Course Objectives:

1. To impart basic knowledge related environment.
2. To train the students to pursue further education.
3. Become familiar with the environment.
4. Gain experience with standard tools.

Course Outcome:

Skills that students obtain after completion of the course:

1. Understanding of the fundamentals of Environmental Studies and key principles of its.
2. Awareness of the major issue at the forefront of the discipline.
3. Ability to dissect a problem in to its key features.

UNIT: I Principles of Ecology, Physical environment; biotic environment; biotic and abiotic interactions, Concept of habitat and niche; fundamental and realized niche; resource partitioning; character displacement.

UNIT: II Characteristics of a population; population growth curves; population regulation; life history strategies (r and K selection); Community: structure and attributes; edges and ecotones; Succession: Types; mechanisms; changes involved in succession; concept of climax.

UNIT: III Ecosystem Organization: Structure and Functions, Primary Production (methods of measurement, controlling factors), Energy Dynamics (trophic organization, energy flow pathways, ecological efficiencies).

UNIT: IV Biological diversity: Concept and levels; distribution and global patterns; terrestrial biodiversity, hot spots; IUCN categories of threat; inventory; conservation.

UNIT: V Environmental pollution: Kinds, sources, effects on plants and ecosystems, greenhouse gases, consequences of climate change; Ozone layer depletion: causes and consequences; Xenobiotics and its impact.

List of Recommended Books:

1. Kormondy E.J., 2000. Concept of Ecology. 4th Edition. Benzamin Cummings. UK.

2. Odum E.P., 1996. Fundamentals of Ecology, Natraj Publishers, Dehradun.

3. Patrick L. 2000.Tropical Ecosystems and Ecological Concepts. Cambridge University Press.UK.

4. Sharma P.D.2007. Ecology and Environment. Rastogi Publication, Meerut.
5. Singh J.S., S.P. Singh and S.R. Gupta 2006.Ecology, Environment and Resource Conservation, Anamya Publication, New Delhi.

PLANT PHYSIOLOGY AND METABOLISM

Code: 0902BY2103

Credit: 4

Course Objectives: **Total Marks: 100 (70+30)**

1. To impart basic knowledge of Plant Physiology.
2. To train the students to pursue further education.
3. To be familiar with plant biology tools.

Course Outcome:

Skills that students obtain after completion of the course:

1. Understanding of the fundamentals of Plant Physiology.
2. Awareness of the major issues at the forefront of the discipline.
3. Ability to dissect a problem in to its key features.
4. Ability to design experiments and understand the limitations of the experimental approach.

UNIT: I Plant Water relations: Osmotic phenomena, Water and osmotic, potential, Absorption of water, Mineral salt absorption, Ascent of Sap, Translocation of organic solutes, passive and active transports; Transpiration: Mechanism and Theories of Stomatal movement, Factors affecting transpiration.

UNIT: II Metabolism: Photosynthesis and Respiration: Light (Hill's) reaction, excitation energy transfer, mechanism of electron and proton transport in chloroplast, photo phosphorylation, photoprotective mechanisms, carbon fixation in C3 and C4 plants, CAM, Glycolysis and Kreb's Cycle.

UNIT: III Plant nutrition, Mineral nutrition and acquisition in plants, Mineral deficiency and toxicity in plants, Nitrogen metabolism, nitrate uptake and assimilation, biological nitrogen fixation, biology of nodule formation in legumes, Phosphate uptake and assimilation, Sulphur uptake and assimilation.

UNIT: IV Stress physiology: Water deficit and drought resistance, Chilling and Freezing, Heat stress and heat shock, Salinity and salt stress, Oxygen deficiency, Metal toxicity and tolerance in plants, Oxidative Stress and Anti-oxidative defense system, Stress induced gene expression.

UNIT: V Sensory photobiology: Phytochromes and cryptochromes, Photoperiodism and its significance, Plant growth regulators: Physiological effects and mechanism of action of plant growth hormones (Auxins, Gibberellins, Cytokinins, Ethylene and Abscisic acid).

List of Recommended Books:

1. Devlin Robert M. 1983. Plant Physiology, Prindle Weber and Schmidt Publisher; 4th edition.UK

2. Devlin Robert M.1983. Plant Physiology, Prindle Weberand Schmidt Publisher; 4th edition.UK

3. Hans Lambers et al. 2008. Plant Physiological Ecology. Springer. Germany.

4. Hopkins and Hunner. 2010. Introduction to Plant Physiology. John Wiley. UK.

5. Salisbury Frankand Cleon Ross 1991. Plant Physiology. Brooks Cole Publishers; 4th edition. USA.

6. Taiz Lincoln and Zeiger Eduardo 2010. Plant Physiology. Sinauer Associates, Inc. Publishers, 5th edition. UK.

FLORAL MORPHOLOGY AND EMBRYOLOGY OF ANGIOSPERMS

Code: 0902BY2104

Course Objectives: **Total Marks 100 (70+30)**

1. To impart basic knowledge of Floral Plant Morphology.
2. To train the students to pursue further education.
3. To be familiar with plant biology tools.

Course Outcome:

Skills that students obtain after completion of the course:

1. Understanding of the fundamentals of Floral Plant Morphology.
2. Awareness of the major issues at the forefront of the discipline.
3. Ability to dissect a problem in to its key features.
4. Ability to design experiments and understand the limitations of the experimental approach.

UNIT: I Morphology of flowers, types of gynoecium, primitive and advanced structure of stamen and carpel, evolutionary trends in placentation.

UNIT: II Microsporangium (Anther), Structure and function of anther wall layers, micro sporogenesis, role of callose and tapetum in pollen development pollen wall morphogenesis ,microspore/pollen mitosis, division of generative cells, pollen fertility and male sterility, pollen storage and pollen viability.

UNIT: III Megasporangium (ovule) structure and types, megasporogenesis, megaspore tetrad, dyad and coenomegaspore (polarity of nuclei) Embryo sac types, ultrastucture of mature embryosac, synergid and antipodal haustoria.

UNIT: IV Pollination, significance of pollen pistil interaction, incompatibility types and methods of overcoming incompatibilities, fertilization, syngamy and triple fusion, Post-fertilization metabolic and structural changes in embryosac.

UNIT: V Endosperm, types and their development, endosperm haustoria and their function, embryogenesis in monocot and dicot angiosperms, suspensor structure, cytology and functions, physiological and morphological relationship of endosperm and embryo, role of embryology in plant breeding.

List of Recommended Books:

1. Bhojwani and Bhatnagar. 2000. The Embryology of Angiosperms. Vikas Publishing House. New Delhi.
2. Chaturvedi, S.K. and Chaturvedi,S. 2001. Biology of reproduction in angiospersm. Bioved research Society, Allahabad.
3. Johri, B.M. 1982. Experimental embryology of vascular plants. Narosa Publishing House, New Delhi
4. Maheshwari, P. 1950. An introduction to the embryology of angiosperms. Mcgraw Hill Book Company. Mumbai.
5. Proctor, M. and Yeo, P. 1973. The pollination of flowers. Collins, St. J. Place. London
6. Raghavan,V. 1999. Developmental biology of flowering plants. Springer verlag, New Delhi.

LAB COURSE III
COMPUTATIONAL BIOLOGY Code: 0902BY2205

Credit 2
Total Marks: 50(35+15)

1. Determine the mean, median and mode from the given sample.
2. Calculate the t values of the given data and determine the its significance.
3. Calculation of analysis of variance from the given sample.
4. Study the sequence homology of the given sequences.
5. Testing the BLAST.
6. Phylogenetic analysis using various bioinformatics methods.

LAB COURSE IV

ECOLOGY AND ENVIRONMENT 0902BY2206

Credit: 4
Total Marks: 100(70+30)

1. To determine the frequency, density, dominance of plant species indifferent terrestrial ecosystems.
2. To estimate IVI of the species in a woodland ecosystem.
3. To study the life form of a woodland ecosystem.
4. To compare protected and unprotected grassland ecosystems using community coefficients (similarity indices).
5. To determine diversity indices (Shannon-Wiener, Concentration of Dominance, Species richness, Equitability and B-diversity) of protected and unprotected ecosystems.
6. Estimation of biomass estimation using harvest method.
7. To determine the water holding capacity of soils collected from different ecosystems.

ECONOMIC BOTANY (0902OE2307)

Credit: 4
Total Marks: 100 (70+30)

Course Objectives:
1. To impart basic knowledge of Economic Botany.
2. To be familiar with the concepts of Economic Botany.
3. To train the students to pursue further education.

Course Outcome:
Skills that students obtain after completion of the course:
1. Understanding of the fundamentals of Economic Botany and key principles of it.
2. Awareness of the major issues at the forefront of the discipline.
3. Ability to dissect a problem in to its key features.

Unit I: Plant Taxonomy and Biosystematics
Nomenclature, purpose, principles and systems of classification; Taxonomy of higher plants, floras, manuals, monographs, index, catalogues and dictionaries, herbaria; Concepts of biosystematics, evolution and differentiation of species; Biosystematic and taxonomic tools; Origin, evolution and biosystematics of selected crops (rice, wheat, rape seed & mustard, cotton).

Unit II: Economically important plants –I
Origin, history, domestication, Botany, genetic resource activities, cultivation, production and use

of: Cereals: Wheat, rice, maize, sorghum, pearl millet and minor millets. Pulses: Pigeon pea, chickpea, black gram, green gram, cowpea, soyabean, pea, lentil, horsegram, lab-lab bean, ricebean, winged bean, French bean, lima bean, sword bean. Oilseeds: Groundnut, sesame, castor, rape seed, mustard, sunflower, safflower, niger, oil palm, coconut and linseed.

Unit III: Economically important plants –II

Origin, distribution, cultivation, production and utilization of economic plants of following groups such as Fibres: cotton, silk cotton, jute, sunnhemp, agave, flax and mesta (kenoff); Sugars: sugarcane, sugarbeet, sugarpalm and sweet sorghum; Fodders and green manure crops: Plantation crops: coconut, cocoa, tea; root and tuber crops-: potato, sweet potato, tapioca, aroids etc.

Unit IV: Economically important plants –III

Origin, distribution, classification, production and utilization of Fruits: mango, banana, citrus, guava, grapes and other indigenous fruits; apple, plum, pear, peach, cashewnut and walnut; Vegetables: tomato, brinjal, okra, cucumber, cole crops, gourds etc.; Fumigatories and masticatories: tobacco, betelvine, areacanut; medicinal and aromatic plants: sarpagandha, belladonna, cinchona, nux-vomica, vinca, mentha and glycirrhiza, plantago etc.; Narcotics: cannabis, datura, gloriosa, pyrethrum and opium; Dye-, tannin-, gum- and resin- yielding plants; Plant of agro-forestory importance: multipurpose trees/shrubs, subabool, Acacia nilotica, poplar, sesbania, neem etc.; non-traditional economic plants: jojoba, guayule, jatropha, carcus etc.

Unit V: Biodiversity and Plant Genetic Resources (PGR)

Biosphere and biodiversity; plant species richness and endemism; concept and importance of plant genetic resources and its increasing erosion; Centres of origin and diversity of crop plants, domestication, evaluation, bioprospecting; National and International organizations associated with PGR; Convention on Biological Diversity (CBD), recent issues related to access and ownership of PGR, IPR,. PBRs, farmers rights, sui-generis system etc.

NANOSCIENCE (0902OE2308)

Credit: 4
Total Marks: 100 (70+30)

Course Objectives:

1. To impart basic knowledge of Nanoscience.
2. To be familiar with different tools of Nanoscience
3. To train the students to pursue further education.

Course Outcome:

Skills that students obtain after completion of the course:

1. Understanding of the fundamentals of Nanoscience and key principles of it.
2. Awareness of the major issues at the forefront of the discipline.

3. Ability to dissect a problem in to its key features.
4. Ability to design experiments and understand the limitations of the experimental approach.

UNIT I

Introduction to Nanotechnology: The Nanoscale Dimension and Paradigm; Definition, History and Current practices; Types of Nanomaterials and their Classifications; Over view of Physical and Chemical Fundamentals of Nanomaterials.

UNIT II

Properties and Characterizations: Optical (UV-Vis/Fluorescence); X-ray diffraction; Imaging and size (Electron microscopy, Light scattering, Zetapotential). Methods of Preparation of Nanomaterials: Top down and Bottom up approaches-emulsifiers, Homogenizers, Sonicator; Over view of Biological Synthesis of Nanoparticles.

UNIT III

Nanomedicine: Nano carriers for Drug delivery, Nanoparticle mediated Drug delivery, Nanotechnology in Drug discovery, Nano-formulation of Herbal Medicine; Nanoscafolds and their use in Cell culture, Organ culture and Tissue Engineering, Regulatory aspects in the approval of Nano medicine, Nano-Cosmetics and other use.

UNIT IV

Nanomaterials and Toxicity Evaluation: Cyto-toxicity, Geno-toxicity, in vivo tests/assays etc.; Toxicological considerations in Nano medicine and Nano-delivery system.

UNIT V

Environmental Applications: Nano clays, Nano adsorbents, Zeolites, Release of Nutrients and Pesticides, Biosensors - Green Technologies - Molecular biomimetic; Nano remediation: Identification and characterization of Hazardous waste; Nano pollution: air - water - soil contaminants; Treatment waters using nano-particles.

List of Books Recommended

1. Nanoscience: Nanobiotechnology and Nanobiology: Boissaeu, Houdy & Lehmani.
2. A-Z Nanobiology: Albert Shawn.
3. Nanotechnology in Biology and Medicine: Methods, Devices and Application, 2007, Tuan Vo-Dinh. CRC press
4. Nanoscience : Nanobiotechnology and Nanobiology (2009) P. Boisseau, P. Houdy and M.Lahmani, (Eds.) Springer, Heidelberg

SEMESTER III

MICROBIAL DIVERSITY (0902BY3101)

Total Marks: 100(70+30)

Course Objectives:

1. To impart basic knowledge of Diversity of microoganisms.
2. To be familiar with different concepts of diversity.
3. To train the students to pursue further education.

Course Outcome:

Skills that students obtain after completion of the course:

1. Understanding of the fundamentals of Diversity and key principles of it.
2. Awareness of the major issues at the forefront of the discipline.
3. Ability to dissect a problem in to its key features.
4. Ability to design experiments and understand the limitations of the experimental approach.

UNIT: I General characters: Mycoplasma; Actinomycetes: *Halobacteria*, *Thermoplama*; Photosynthesisinbacteria: Anoxygenic photosynthesis in purple bacteria, chemo synthetic bacteria; methanogens and methanotrophs; Sexuality and Genetic recombination in Bacteria.

UNIT: II General account and classification of viruses, Bacteriophages: T4, Lambda, Mu, lytic and lysogenic cycle, regulation of lysis and lysogeny in lambdaphage, Cyanophages and Myco viruses; Viroids and Prions.

UNIT: III General characteristics of fungi: Distribution, Mode of nutrition, Reproduction: Vegetative, Asexual and Sexual reproduction and general principles of classification of fungi. Heterothallism and parasexuality; economic importance of fungi.

UNIT: IV General characteristics features of orders Plasmodiophorales, Chytridiales Peronosporales, Mucorales, Protomycetales, Erysiphales and Pezizales.

UNIT: V Uredinales, Ustilaginales, Agaricales and Melanconiales, Moniliales; Mycorrhiza.

List of Recommended Books

1. Alexopoulos, C.J. Mims, C.W. and Blackwell, M. 1996 - Introductory Mycology. John Wiley Publications.UK.

2. Madigan M. et al. 2001. Brocks biology of Microorganisms. Pearson. USA.

3. Mehrotra R.S. and Aneja K.R. An Introduction to Myocology. New Age International

Publishers. New Delhi.

4. Prescott, Harley and Kleins. 2001. Microbiology, McGraw-Hill Education. USA.

5. Webster, J.2007.An Introduction to Fungi. Cambridge Univ. Press. New Delhi.

GENETICS AND BREEDING (0902BY3102)

Total Marks: 100 (70+30)

Course Objectives:

1. To impart basic knowledge of Genetics and Breeding.
2. To be familiar with different concepts of Genetics and Breeding.
3. To train the students to pursue further education.

Course Outcome:

Skills that students obtain after completion of the course:

1. Understanding of the fundamentals of Genetics and Breeding and key principles of it.
2. Awareness of the major issues at the forefront of the discipline.
3. Ability to dissect a problem in to its key features.
4. Ability to design experiments and understand the limitations of the experimental approach.

UNIT: I Classical genetics: Mendelian principles, Segregation, Independent Assortment; incomplete dominance,Co-dominance, Gene interactions, Epistasis, Chromosomal theory of inheritance, sex chromosomes and determination, dosage compensation, Extra nuclear inheritance.

UNIT: II Arrangement of genetic material: linkage and recombination, genetic and cytological crossing over, genetic and chromosome mapping, Change and structure of genetic material: Chromosome variation in number, Euploidy, Aneuploidy, polyploids. Changes in chromosome structure: deficiencies, duplications, translocations, Gene mutation.

UNIT: III Population Genetics: Population models, probability and distributions, Genotypic and phenotypic variation, Hardy-Weinberg, measures of genetic variation Gene frequencies and equilibrium, optimum phenotype and selection pressure, kinds of selection; Fisher's fundamental theorem of Natural selection.

UNIT: IV Genomics and Molecular Genetics: Maps of Chromosomes, Map position-based cloning of genes: Chromosome walks, chromosome jumps, Expressed sequences, Comparative genomics: Mitochondrial and Chloroplast genomes, genome evolution in plants.

UNIT: V Plant breeding: objectives and scope, hybridization in self-pollinated crops and cross-pollinated crops, inbreeding depression and heterosis, polyploidy breeding; breeding for disease resistance plants, molecular markers and plant breeding.

List of Recommended Books:

1. Alberts B. Johnson, A. Lewis, J.Raff, M.Roberts, K.Walter, P. 2008. Molecular Biology of the Cell. Garland Science Publisher. USA.

2.Benzamin Lewin. 2011. GeneX. Jones and Batlett. Learning Publisher. USA.

3.Clugg and Cummings. 2011. Concepts of Genetics. Benzamin Cumming Publishing Company. UK.

4. Russel, P.J. 2010. Genetics. Benzamin Cumming Publishing Company. UK.

5. Singh, B.D. 2007. Plant Breeding. Kalyani Publications. New Delhi.

6.Tamarin. 2001. Genetics. McGraw Hill. New Delhi.

PLANT PATHOLOGY (0902BY3103)

Total Marks: 100 (70+30)

Course Objectives:

1. To impart basic knowledge of Plant Pathology.
2. To be familiar with different concepts of Plant Pathology.
3. To train the students to pursue further education.

Course Outcome:

Skills that students obtain after completion of the course:

1. Understanding of the fundamentals of Plant Pathology and key principles of it.
2. Awareness of the major issues at the forefront of the discipline.
3. Ability to dissect a problem in to its key features.
4. Ability to design experiments and understand the limitations of the experimental approach.

UNIT: I History of plant pathology, identification of symptoms and signs, observation of symptoms, isolation, growth and identification of causal agents, losses caused by plant diseases, basic procedure in diagnosis of plant diseases.

UNIT: II Parasitism and pathogenecity, development of plant diseases, inoculations, penetration, infection, dissemination of pathogen, oxidative burst, PR proteins, SAR, phytoalexins, factors affecting distribution of disease.

UNIT: III Pathogenesis, Chemical weapons of pathogens, microbial toxins, growth regulators and detoxification of antimicrobial molecules in disease development Pre-existing defense structures, pre-existing chemical defense, induced structural and biochemical defense.

UNIT: IV Nature and properties of pathogenic bacteria, viruses, mycoplasma and nematodes, symptoms, transmission, characterization. Study of plant disease caused by Bacteria, Viruses,

Mycoplasma and Nematodes and their control measures.

UNIT: V Study of fungal diseases, symptoms caused by fungi on plants, mechanisms of infection, penetration, colonization and their control measures. General account of some important fungal diseases of economically important crops of central India and their control measures.

List of Recommended Books:

1. Aggrawal Ashok and Mehrotra R S. 2002. Plant Pathology. Tata Mcgraw Hill, 2nd edition. Mumbai.

2. Agrios George N. 2005. Plant Pathology, Academic Press, 5th Edition.UK.

3. Robert B. 2008. Plant Pathology: Techniques and Protocols (Methods in Molecular Biology), Humana Press.USA.

4. Gail L. Schumann and Cleora J.D' Arcy 2009.Essential Plant Pathology, 2nd Edition. American Phytopathological Society.USA.

5. Sharma P.2006. Plant Pathology, Alpha Science International Ltd. New Delhi.

ANGIOSPERMS TAXONOMY AND PHYTOGEOGRAPHY (0902BY3104)

Total Marks : 100 (70+30)

Course Objectives:

1. To impart basic knowledge of Taxonomy and Phytogeography of Angiosperms.
2. To be familiar with different Taxonomical and Phytogeographical concepts of Angiosperms.
3. To train the students to pursue further education.

Course Outcome:

Skills that students obtain after completion of the course:

1. Understanding of the fundamentals of Taxonomy and Phytogeography of Angiosperms and key principles of it.
2. Awareness of the major issues at the forefront of the discipline.
3. Ability to dissect a problem in to its key features.
4. Ability to design experiments and understand the limitations of the experimental approach.

UNIT: I Taxonomic hierarchy, delimitation of taxa and attribution of rank. Typification, International Code of Botanical Nomenclature Salient Features Principles, important Rules and Recommendations, Provisions for the governance of the Code. Biosystematics.

UNIT: II Herbarium, flora, histological, cytological, serological, morphology, anatomy, palynology, embryology, phytochemistry, numerical taxonomy, DNA barcoding.

UNIT: III Phenitic versus phylogenetic systems, clasistics in taxonomy, relative merits and demerits of major systems of classification, relevance of taxonomy to conservation, Angiosperm phylogeny group (AGP), ancestors of Angiosperms, Interrelationship among the major groups of Angiosperms.

UNIT: IV Ranunculaceae, Capparidaceae, Malvaceae, Cucurbitaceae, Apiaceae, Rubiaceae, Asteraceae, Asclepiadaceae, Acanthaceae, Lamiaceae, Euphorbiaceae, Moraceae, Cyperaceae, Arecaceae, Poaceae, Nymphaeaceae.

UNIT: V A brief idea of Phytogeography, Phyto-geographical regions of the world with special reference to the Indian sub-continent, Endemism, Major vegetation, forest types of India and their distribution, Grassland types and their distribution in India.

List of Recommended Books:

1. Davis, P.H. and V.H. Heywood. 1991. Principles of Angiosperm Taxonomy. Today and Tomorrow Publications, New Delhi
2. Eames, A.J. 1961. Morphology of Angiosperms. McGraw Hill, NY.
3. Naik,V.N.1984.Taxonomy of Angiosperms Tata McGraw-Hill Publication Com
4. Pandey, B.P. 2007. Taxonomy of Angiosperms. S. Chand and Company Limited. New Delhi.
5. Sharma, O.P. 2009. Plant Taxonomy. Tata McGraw-Hill. Mumbai.
6. Singh Gurcharan. 2004. Plant Systematics: Theory and practice Oxford and YBH Publishing Co. Pvt. Ltd., New Delhi.

LAB COURSE V
MICROBIAL DIVERSITY (0902BY3205)

Total Marks: 50(35+15)

1. Isolation, purification and maintenance of microbial culture from soil sample
2. Study of the growth behavior and determination of generation time
3. Antibiotic resistance pattern in microbial culture
4. Staining of bacteria by gram's stain method
5. Total cell counting of a microbial culture
6. Isolation of fungi from the rhizospheric soil

7. Preparation of slides and study of specimens of important fungi
8. Collection and study of aeromycoflora
9. Preparation of PDA media in the laboratory
10. Isolation and cultivation of fungus on PDA medium.

LAB COURSE VI

GENETICS AND BREEDING (0902BY3206)

Total Marks: 50 (35+15)

1. Demonstration of special chromosomes of plants.
2. To study the spontaneous mutation by replica plating method.
3. To study the induced mutation in the selected organism.
4. Isolation of antibiotic resistant mutant by gradient plate technique.
5. Theoretical problems based on genetics.
6. Determination of χ^2.
7. Demonstration various plant breeding techniques.
8. Study of molecular markers.
9. Construction of genetic maps.

MEDICINAL AND PHARMACEUTICAL CHEMISTRY (0902OE3307)

Total Marks: 100 (70+30)

Course Objectives:

1. To impart basic knowledge of Medicinal and Pharmaceutical Chemistry.
2. To be familiar with different concepts of Medicinal and Pharmaceutical Chemistry.
3. To train the students to pursue further education.

Course Outcome:

Skills that students obtain after completion of the course:

1. Understanding of the fundamentals of Medicinal and Pharmaceutical Chemistry and key principles of it.
2. Awareness of the major issues at the forefront of the discipline.
3. Ability to dissect a problem in to its key features.
4. Ability to design experiments and understand the limitations of the experimental approach.

UN IT I

Local Anti Infective Drugs: Introduction and general mode of action, synthesis of sulphonamides, furazolidone, nalidixic acid, ciprofloxacin, norfloxacin, dapsone, amino salicylic acid, isoniazid, ethionamide, ethambutal, fluconazole and griseofulvin.

UNIT II

Antimalarials: Synthesis and properties of the following Anti malarial, 8-amino quinoline derivatives pamaquine, primaquine, pentaquine, isopentaquine, 4-amino quinoline, derivatives- santoquine, camaquine, acridine derivatives-mepacrine, azacrin, pyrimidine and biquanide, derivatives-paludrine, pyremethamine.

UNIT III

Cardiovascular Drugs: Introduction, cardiovascular diseases, drug inhibitors of peripheral sympathetic function, central intervention of cardiovascular output. Direct acting arteriolar dilators synthesis of amylnitrate, quindine methylopa, sorbitrate and atenolol.

Antineoplastic Drugs: - Introduction, cancer chemotherapy, special problems, role of alkylating agents and anti metabolites in treatment of cancer. Mention of carcinolytic antibiotics and mitotic inhibitors. Synthesis of mechlorethamine, cyclophosphamide, melphalan, uracil, mustards and 6-mercaptopurine.

UNIT IV

Drug Design: Development of new drugs, procedure followed in drug design, concept of lead compound and lead modification, concept of prodrug and soft drug, Structure activity relationship (SAR), factors affecting bioactivity, Quantitative structure activity relationship (QSAR), Concept of drug receptors, Physico-chemical parameter, lipophylicity, partition coefficient, Free-Wilson analysis, Hansch analysis, relationship between Free-Wilson and Hansch analysis, LD-50, ED-50 (Mathematical derivation of equations. excluded).

UNIT V

Pharmacokinetics: Introduction to drug adsorption, disposition, elimination using pharmacokinetics, important pharmacokinetic, parameter in defining drug disposition and in therapeutics', Mention of uses of pharmacokinetics in drug development process. Pharmacodynamics: Introduction, elementary, treatment of enzyme stimulation, enzyme inhibition, membrane active drugs, drug metabolism, xenobiotics, biotransformation, significance of drug metabolism in medicinal chemistry

List of Recommended Books:

1. Natural Products Chemistry and Biological Significance, J. Mann, R.S. Davidson, J.B. Hobbs.
2. Organic Chemistry, D.V. Banthrope, Longman Essex, J. B. Harbrone.
3. Streoselective Synthesis, M.Nogradi and CHV. Odds Chemistry of Carbon Compounds, ED.S. Coffey, Elsevier.
4. Biological and Pharmacological Properties of Medicinal Plants from Americans, M. P. Gupta and A. Marston, Harwood Academic Publishers.

5. Introduction to Flavonoids, B. A. Bohm. Harwood Academic Publishers.
6. New Trends in Natural Products, Rahman and M.I. Choudhary.
7. Insecticides of Natural Origin, Sukh Dev.
8. Text Book of organic Medicinal and Pharmaceutical Chemistry, Robert F. Dorde.
9. An Introduction to Drug Design, S.S. Pandeya and J.R. Dimmock.
10. Berger's Medicinal Chemistry and Drug Discovery, Vol-I (Chapter-9 and Ch-14). Goodman and
11. Gillman's Pharmacological Basis of Therapeutics, Mc Graw Hill.
12. The Organic Chemistry of Drug Design and drug Action, R.B. Silverman. Strategies for Organic
13. Synthesis and Design, D. Lednicer, John Wiley.
14. Burger. Medicinal Chemistry and Drug Discovery, Vol-1, Ed. M. E. Wolff, John Wiley (1994).
15. Goodman & Gilman. Pharmacological Basis of Therapeutics, McGraw-HilI (2005).
16. S. S. Pandeya & J. R. Dimmock.Introduction to Drug Design, New Age International.(2000).
17. D. Lednicer. Strategies for Organic Drug Synthesis and Design, John Wiley (1998).
18. Graham & Patrick. Introduction to Medicinal Chemistry (3rd edn.), OUP (2005)

ENVIRONMENTAL BIOTECHNOLOGY
Code: 02BY3308

Credit: 4
Total Marks: 100 (70+30)

Course Objectives:
1. To impart in-depth knowledge related to environmental biotechnology
2. Become familiar with the environment.
3. To train the students to pursue further education.
4. Gain experience with standard tools.

Course Outcome:
Skills that students obtain after completion of the course:
1. Understanding of the fundamentals of Environmental Biotechnology and key principles of its.
2. Awareness of the major issue at the forefront of the discipline.
3. Ability to dissect a problem in to its key features.
4. Ability to design experiments and understand the limitations of the experimental approach.

UNIT I
Environment: Basic concepts and issues. Environmental pollution: types of pollution, methods for measurement of pollution, methodology of environmental management- the problem solving approach, its limitations. Air pollution and its control through biotechnology.

UNIT II
Water Pollution and its control: water as a natural scarce resource, need for water management, measurement of water pollution, waste water collection, waste water treatment- physical, chemical and biological treatment processes. Microbiology of waste water treatment, Aerobic Processes – activated sludge, oxidation ditches,

trickling filter, towers, rotating discs, rotating drums, oxidation ponds. Anaerobic Processes – Anaerobic digestion, anaerobic filters, up-flow anaerobic sludge, blanket reactors.

UNIT III

Treatment schemes for waste waters of dairy, distillery, tannery, sugar and antibiotic industry. Microbiology of degradation of xenobiotics in environment; Ecological considerations, decay behavior and degradative plasmids, hydrocarbons, substituted hydrocarbons, oil pollution, surfactants, and pesticides. Bioremediation of contaminated oils and waste lands.

UNIT IV

Bio-pesticides in integrated pest management. Solid waste: sources and management (composting, vermiculture and methane production). Global environmental problem: Ozone depletion, UV-B, green house effect and acid rain, their impact, and biotechnological approaches for management.

UNIT V

Role of international and national organizations in Biotechnology; Cooperative efforts, government programs for biotechnology developments and applications, patenting biotechnical processes and production in different countries, regulation for biohazardous products.

List of Recommended Books:

1. Comprehensive Biotechnology (Vol. 1-4): M.Y. Young (Eds.), Pergamon Press, Oxford.
2. Environmental Microbiology: W.D. Grant & P.E. Long, Blakie, Glassgow and London.
3. Microbial Gene Technology: H. Polasa (ED.) South Asian Publishers, New Delhi.
4. Bio-treatment Systems, Vol. 22, D. L. Wise (Ed.), CRC Press, INC.
5. Environmental Biotechnology: Alan and Scragg; Pearson Education Ltd. England.
6. Environmental Biotechnology: S.N. Jogdand; Himlaya Publishing House Bombay.
7. Waste Water Engineering – Treatment, Disposal and reuse: Metcalf and Eddy.
8. A.K.De, Environmental Chemistry Willey Eastern Ltd. New Delhi.
9. Introduction to Biodeterioration: D. Allsopp and K.J. Seal, ELBS/Edward Arnold.

SEMESTER IV

PLANT MOLECULAR BIOLOGY: GENETIC ENGINEERING (0902BY4101)

Total Marks:-100 (70+30)

Course Objectives:

1. To impart in-depth knowledge related to Plant Molecular Biology and Genetic Engineering.
2. Become familiar with the molecular biology techniques.
3. To train the students to pursue further education.
4. Gain experience with standard molecular tools.

Course Outcome:

Skills that students obtain after completion of the course:

1. Understanding of the fundamentals of Plant Molecular Biology and Genetic Engineering and key principles of its.
2. Awareness of the major issue at the forefront of the discipline.
3. Ability to dissect a problem in to its key features.
4. Ability to design experiments and understand the limitations of the experimental approach.

UNIT: I Basic concepts of DNA structure and properties, restriction enzymes, DNA ligase, Klenow enzyme, T4 DNA polymerase, Polynucleotide kinase, Alkaline phosphatise, Cohesive and blunt end ligation.

UNIT: II Hybridization techniques, Northern, Southern and Colony Hybridization, Fluorescence insitu hybridization, Chromatin immunoprecipitation, footprinting, Isolation of Plasmid, DNA and Bacteriophage DNA. Isolation of total RNA and mRNA.

UNIT: III Plasmids, Bacteriophages, pBR322 and pUC series of vectors, M13 and P2 phase-based vectors, High capacity vectors: Cosmids, phagemid, phasemid, YAC, BAC, Animal and Plant virus based cloning vectors, Shuttle vectors, Expression vectors, pMal, GST, pET-based vectors, Insertion of foreign DNA into Host Cells, Transformation

UNIT: IV Primer designing, Fidelity of the rmo stable enzymes, DNA polymerase, Types of PCR-multiplex, nested, reverse transcriptase, realtime PCR, touchdown PCR, hotstart PCR, colony PCR, insitu PCR, cloning of PCR products, Introduction of DNA into plant cells, transfection techniques.

UNIT: V Constructions of libraries, cDNA and genomic libraries, cDNA and genomic cloning, Expression cloning Protein-protein interactive cloning and Yeast two hybrid system, Phage display.

List of Recommended Books:

1. Brown T.A. 2007. Genomes 3.Garland Science Publication.USA.
2. Brown T.A.2011. Gene Cloning and DNA Analysis. Taylor and Francis.UK.

3. Primrose and Twyman, 2009. Principles of Gene manipulation and Genomics, Wiley-Blackwell Publishing. UK.

PLANT RESOURCE UTILIZATION AND CONSERVATION (0902BY4102)

Total Marks: 100 (70+30)

Course Objectives:

1. To impart in-depth knowledge related to Utilization and Conservation of Plant Resources.
2. Become familiar with the concepts related to Utilization and Conservation of Plant Resources.
3. To train the students to pursue further education.
4. Gain experience with standard tools.

Course Outcome:

Skills that students obtain after completion of the course:

1. Understanding of the fundamentals of Utilization and Conservation of Plant Resources and key principles of its.
2. Awareness of the major issue at the forefront of the discipline.
3. Ability to dissect a problem in to its key features.
4. Ability to design experiments and understand the limitations of the experimental approach.

UNIT: I General aspects on resource types: Renewable resources, non-renewable resources, Resource degradation, Resource conservation; Natural resources, biological resources, plants as natural resources.

UNIT: II Utilization of plant resources, Bio-control-sources and advantages, Bio-control as agribusiness, Untapped potential plant resources, seaweeds as potential resources– food, fodder and bio-fertilizer; Plant resources used in cosmetics, aromatics and pharmaceuticals, fibers; forest as potential resources: vegetable oil yielding plants, bio-energy.

UNIT: III Biodiversity, Levels and types of biodiversity, uses of biodiversity, Distribution of biodiversity, Regional pattern of biodiversity, Hot spots of biodiversity, Threats to biodiversity– Habitat loss and fragmentation, Alien invasive species, disturbance and pollution, harvesting and over-exploitation.

UNIT: IV An overview of Indian biodiversity; Biogeographic regions (zone) of India; Hot spots of Indian biodiversity; Status of biodiversity conservation in India; Protected area network of India;TheBiologicalDiversityAct2002;Bio-prospecting–Biochemical resources from plants.

UNIT: V Conservation of Biodiversity; IUCN red list categories, In situ conservation strategies – Protected areas, Biosphere reserves; Ex-situ conservation strategies – Restoration of endangered species, Sustainable use and public participation; International efforts for conserving biodiversity.

List of Recommended Books:

1. Chandel K. P., S. Shukla G. and Sharma Neelam. 1996. Biodiversity in Medicinal and Aromatic Plants in India–Conservation and Utilization, Indian Bureau of Plant Genetic Resources, New Delhi

2. Kaufman Peter B. et al. 1999.Natural Products from Plants, CRC Press. UK.

3. Primack R. B. 2000. A Primer of Conservation Biology, Sinauer Asso. Publ., Massachusetts. USA.

4. Sahoo S. 2002. Plant Resource Utilization. Allied Publishers. Nagpur.

5. Singh J. S. Singh S. P. and Gupta S. R., 2006, Ecology, Environment and Resource Conservation, Anamya Publication, New Delhi.

6. Trivedi P.C. and Sharma N. 2010. Plant Resource Utilization and Conservation, Pointer Publishers. Jaipur.

DISSERTATION (0902BY4103)

Total Marks: 200 (150+50)

(A) : Project work/ Dissertation

Topic will be based on the major elective opted by students. Project will include laboratory/field-based work followed by submission of report and presentation.

(B) : Seminar

Students are required to deliver a seminar on a current topic related to the subject and to be evaluated by a panel of examiners.

LAB COURSE VII

PLANT MOLECULAR BIOLOGY: GENETIC ENGINEERING LAB (0902BY4204)

Total Marks: 50 (35+15)

1. Isolation of genomic DNA from plant cell.
2. Restriction digestion of plant DNA.
3. Isolation of total RNA from plant cell.
4. Preparation of competent cells using $CaCl_2$.
5. Synthesis of cDNA and analyses of mRNA expression using RT/RealTime PCR.
6. Isolation of plasmid DNA from bacteria.
7. Transformation study in *E.coli*.
8. PCR amplification of the selected plant gene

LAB COURSE VIII
PLANT RESOURCE UTILIZATION AND CONSERVATION (0902BY4205)

Total Marks:- 50 (35+15)

1. Study of fodder, food, fire, oil, fibre and oil of plants (five each)
2. Study of locally available medicinal and aromatic plants.
3. Study of Gums, resins, tannins, dyes yielding plants of Raipur, (CG).
4. Local Field study tour for plant wealth survey and report writing.

WATER POLLUTION MANAGEMENT (0902OE4306)

Total: 100 (70+30)

Course Objectives:

1. To impart in-depth knowledge related to Water pollution and its management.
2. Become familiar with the concepts related to Water pollution and its management.
3. To train the students to pursue further education.
4. Gain experience with standard tools.

Course Outcome:

Skills that students obtain after completion of the course:

1. Understanding of the fundamentals of Water pollution and its management and key principles of its.
2. Awareness of the major issue at the forefront of the discipline.
3. Ability to dissect a problem in to its key features.
4. Ability to design experiments and understand the limitations of the experimental approach.

UNIT: I Sources of water pollution, Physico-chemical and biological properties of sewage, industrial effluents produced from textile, leather, thermal power, chemical and mining industries and their effects on water quality, bio-indicators of water pollution.

UNIT: II Domestic wastewater treatment: Various stages of treatment of sewage with special reference to advanced waste water treatments; biological treatment of wastewater.

UNIT: III Industrial wastewater treatment: Treatment of industrial effluents released from textile, leather, thermal power, chemical and mining industries.

UNIT: IV Disinfection of treated water: Ozonization of secondary treated wastewater; chemical and other methods for disinfection, recycling of industrial effluents after treatment.

UNIT: V Water pollution monitoring and management bodies: Important organizations involved in water pollution monitoring in India.

List of Recommended Books:

1. Agrawal S.K., 2009. Water Pollution. APH Publishing House. New Delhi.

2. Goel P.K. ,2006. Water Pollution. New Age International. New Delhi.

3. Henze M., Harremoës P., Jansen, and Arvin, E., 2002. Wastewater Treatment: Biological and Chemical processes, Springer Publication. Germany.

4. Marcosvon Sperling, 2007. Basic Principles of Wastewater Treatment: IWA Publishing Company. UK.

5. Wang Lawrence. 2009. Handbook of advanced industrial and hazardous wastes treatment. CRC Press. UK.

6. WunJern Ng. 2006. Industrial Wastewater Treatment. Imperial College Press.UK.

AIRPOLLUTION AND CLIMATE CHANGE (0902OE4307)

Total Marks:-100(70+30)

Course Objectives:

1. To impart in-depth knowledge related to Air pollution and Climate Change.
2. Become familiar with the concepts related to Air pollution and Climate Change.
3. To train the students to pursue further education.
4. Gain experience with standard tools.

Course Outcome:

Skills that students obtain after completion of the course:

1. Understanding of the fundamentals of Air pollution and Climate Change and key principles of its.
2. Awareness of the major issue at the forefront of the discipline.
3. Ability to dissect a problem in to its key features.
4. Ability to design experiments and understand the limitations of the experimental approach.

UNIT: I Gaseous and particulate pollutants, indoor air pollution, Effects of important air pollutants on plants, human health and ecosystems.

UNIT: II Photochemical smog, stratospheric ozone depletion; effects of enhanced UV-B on plants, microbes and human health. Acid rain: Formation, dispersion and deposition; consequences on soil fertility, rivers, lakes and plants.

UNIT: III Greenhouse effects: consequences, global warming, sea level rise, albedo, oceanic influences; effects of increased CO_2 on plants; human implications. Surface cooling.

UNIT: IV Biomonitoring of air pollution: Concept, active and passive monitoring; bio-indicator parameters; airpollution tolerance indices; control of airpollution by plants.

UNIT: V Plant atmosphere exchange of trace gases: Biogenic volatile organic compounds (BVOCs) and their importance in global climate change. Impact of eco-physiological factors on the exchange of trace gases.

List of Recommonded Books:

1. Adger, W.N. 2005. Adapting to climate change. Wiley Publication.UK.
2. Arthur, C.Stern. 1997. Fundamentals of air pollution. Wiley Publishers, UK.
3. Arya Arun. 2009. Eco-degradation due to air pollution. Narosa Publishers. New Delhi
4. Bell and Treshow 2002. Air Pollution and Plant Life.Wiley Publication. UK.
5. Kenneth,Wark. 1997. Air Pollution its origin and control, Prentice Hall publication. UK
6. Pepper, Ian. 2003. Environmental chemistry. Wiley Publication.UK.