Minutes of the
13th Meeting of the Board of Studies
of
Department of Botany
Central University of Jammu

Venue: Office of Head, Department of Botany, CUJ, Bagla

Date: Friday, 27th May 2022

Time: 11:00 am

Department of Botany
Central University of Jammu

Date: 27th May 2022

No.CUJ/BOT/2022/

MINUTES OF THE 13th MEETING OF BOARD OF STUDIES (BOS) OF DEPARTMENT BOTANY

Minutes of the 13th meeting of the Board of Studies of Department of Botany held on 27th May 2022 at 11.0 in Office of Head, Department of Botany, Central University of Jammu.

11.2 The following members attended the meeting:

Name	Affiliation	
Prof. B. S. Bhau,	Head, Department of Botany, CUJ	Chairman
Prof. Veenu Koul	HOD, Department of Botany, University of Jammu, Jammu	External Expert Memb
Prof. Namrata Sharma	Department of Botany, University of Jammu, Jammu	External Expert Memb
Dr. S. Vaishnavi	Assistant Professor, Department of Botany, CUJ	Member Secretary
Dr. D. Bhardwaj	Assistant Professor, Department of Botany, CUJ	Special invitee

Prof. AK Wakhlu, Department of Botany, University of Jammu and Dr. A. Bhat, Assistant Profes Centre for Moleoular Biology, CUJ were unable to attend the meeting because of unavoid circumstances.

1 **Opening remarks by the Chair**

The Chairman welcomed all the members and thanked them for making it convenient to attend meeting and providing invaluable inputs.

2 **To revise and approve the course matrix for Five Year Integrated B.Sc.-M.Sc. Botany Programme according to National Education Policy (NEP-2020) w.e.f Academic Session 2022-2023.**

The draft course matrix and course contents as approved by the Board are placed at Annexure – 1.

3 **To approve the Learning Outcome based Curriculum Framework (LOCF) of Five-Year Integrated B.Sc.-M.Sc. Botany Programme and syllabus of semesters I and II according to National Education Policy (NEP-2020) w.e.f Academic Session 2022-2023.**

The Board considered and approved the Learning Outcome based Curriculum Framework (LOCF) of Five-Year Integrated B.Sc.-M.Sc. Botany Programme and syllabus of semesters I, and according to National Education Policy (NEP-2020) and is placed at Annexure – 1.

4. **To approve the syllabus of Open Elective courses offered by the department w.e.f Academic Session 2022-2023.**

The Board considered and approved the Open elective courses and their content with modifications and is placed at Annexure – 1.

5 **To consider and approve the minutes of meeting of DRC held on 20/05/22**

Minutes of meeting of the DRC held on 21/05/2022 were approved with the following observations:

a. **To review and approve progress report of Ph.D. scholar Mr. Aksar Ali Chawdhary (0151718) for the continuation of the university fellowship**

The RAC committee has evaluated the Ph.D. work progress of Aksar Ali Chowdhary satisfactory and found to be excellent. The scholar has two published review papers during the period and one research papers of his PhD work under communication. The committee further observed that the future of PhD dissertation (Alleviation of lead toxicity using H_2S and NO as well as H_2S and NO interaction during cadmium and lead toxicity) may require a year, therefore recommended extension for his university funded fellowship for one-year.

b. To review and approve progress report of Ph.D. scholar Ms. Shreya Proch (0451

The RAC committee has evaluated the Ph.D. work progress of Ms. Shreya Proch satisfactory. The scholar was advised to publish a review article at the earliest. Levels of drought stress to be administered to *Phaseolus vulgaris* L.' should characterized.

c. To review and approve progress report of Ph.D. scholar Ms. Barkha Pa (0151719).

The RAC committee has evaluated the Ph.D. work progress of Ms. Barkha P satisfactory. RAC suggested to isolate fungal spp., besides *Trichoderma* rhizosphere of *Phaseolus vulgaris* L. with antagonistic activity against *Colleto lindemuthianum.* Collection of natural accessions of *Phaseolus vulgaris* L. sho done. The scholar was advised to communicate a review article at the earliest.

d. To review and approve progress report of Ph.D. scholar Ms. Komal Sh (0351719)

The progress report presented by Ms. Komal was found to be satisfactory. The sc was advised to get the plant identification approved by some additional authenti sources and make every effort to collect the plant material from as many location possible. The scholar was advised to communicate a review article at the earliest.

e. To review and approve progress report of Ph.D. scholar Ms. Jyotipriya Samant (0251719)

The expert members of the research advisory committee resolved that: The title o study i.e., 'To study the biodiversity of Arbuscular Mycorrhizal Fungi in medici important *Justicia adathoda* plantation of Jammu region and its effects on the leve vasicine and vasicinone' should be modified as 'To study the diversity of Arbus Mycorrhizal Fungi in medicinally important *Justicia adathoda* L. and its effects o levels of vasicine and vasicinone.

f. To approve thesis title and synopsis of Ms. Vrinda Sharma (0151720)

Proposed title 'Studies on genetic diversity of some selected *Ipomoea* L. species' was approved. The sampling area for the proposed study should be restricted to the two districts. Jammu and Samba, and not the entire Jammu region of J&K to enable completion of objectives in stipulated time frame. The objectives were accordingly modified.

6. Any other item with the permission of Chairman BOS.

a. Course structure for the upcoming 5th semester (2022-23) was placed before the Board. considered and approved by the Board. The syllabus of all the courses included have been approved previously, and the Skill Enhancement course stands approved in current BOS. Course structure for the upcoming 5th semester (2022-23) was approved by the Board.

b. Post facto approval for offering of 'Introduction to Computers' as a Foundation course to the semester V of the Integrated B.Sc. (Hons.) and M. Sc. in Botany programme (AY 2021-22). As per approved course structure, the batch admitted in 2019 was supposed to complete four Foundation courses (4x4=16), one each in semesters I – IV. However, no Foundation course could be offered to this batch in their semester IV (Feb. – June, 2021) due to some unavoidable circumstances. The students in their semester V. had three core theory courses (3x4=12 credits), three core lab courses (3x2=6 credits), one elective theory course (1x4=4credits) and one elective lab course (1x2=2 credits) adding up to 32 hours/week. The missed Foundation course was sought to be compensated for by offering an Introductory course on computers. Such a course 'Introduction to Computers' was being offered by the Department of Computer Science and Information Technology as an interdisciplinary course, and the same was offered as a Foundation course to fulfil the requirement to the semester V students as they had not taken any course on Computer skills previously. Considering the above, pending approval of the Academic Bodies, HVC kindly accorded approval to offering of 'Introduction to Computers' as a Foundation course to the semester V of the Integrated B.Sc. (Hons.) and M. Sc. in Botany programme (AY 2021-22). The detailed contents of the course offered are placed alongside for kind perusal. Post facto approval was granted for the same by the Board.

7. The Meeting ended with a vote of thanks to the Chair.

Prof. Veenu Koul

Prof. Namrata Sharma

Dr. S. Vaishnavi

Dr. D. Bhardwaj

Prof. B. S. Bhau

Course title: Plant Kingdom - Diversity in forms, structure and reproduction

Course code: BOT1C001T
Maximum marks: 100

Credit: 4
Total teaching hours: 60 (45 theory + 15 lab)

Course objectives

The objective of the plant diversity paper is to introduce young collegiate minds to myriad aspects of the plant world. Ranging from the smallest blue green algae to the tallest Californian *Sequioa*, it is very vast and fascinating. This paper will give the overview of the plant kingdom and its subgroups such as thallophytes, cryptogams, and phanerogams. It is interesting to notice that various subgroups are interlinked and follow evolutionary pathways. This paper also has a section of microbes which does not come under kingdom plantae. Bacteria and viruses are covered in this section.

Learning outcomes

On completion of the course, students will be able to:

1) Explain the diversity of forms and structure among Algae.
2) Explain the biodiversity of Fungi and learn about the economic importance of Fungi.
3) Explain the morphological diversity and uses of Lichens.
4) Explain the morphological diversity of Bryophytes, Pteridophytes, Gymnosperms and Angiosperms.
5) Explain the morphology, structure and reproduction in bacteria and viruses.

THEORY

Unit I: Introduction to plant diversity

Diversity of Life on Earth, characteristics of Living Things, origin of Life, organization of Cells – Prokaryotes and Eukaryotes, evolution by endosymbiosis, classification of organisms - The Five Kingdoms, characteristics of plants, and their diversity. Domains of organisms of primary and ancient lineage

Unit II: Microbes and Algae

Viruses – Discovery, general structure, replication, DNA and RNA viruses, lytic and lysogenic cycle; Bacteria – Discovery, General characteristics, cell structure, modes of reproduction; Algal diversity – Major classes, origin, occurrence, habitat, thallus, cell structure, pigments and reserve food, general reproduction and life cycle

Unit III: Fungi and Cryptogams

Fungal diversity- Major classes, origin, occurrence, cell structure, general reproduction and life cycle, Lichen diversity – Major classes, morphology and reproduction; economic importance (as pollution indicator), Bryophytes- origin, occurrence, thallus, reproduction, and life cycle. Pteridophytes – Major classes, origin, occurrence, sporophyte, gametophyte, reproduction, and life cycles

Unit IV: Phanerogams

Gymnosperms – Major classes, origin, occurrence, general characteristics, reproduction, life cycle, affinities with pteridophytes and angiosperms. Angiosperms – Major classes, origin, occurrence, introduction to monocots and dicots, modes of reproduction

PRACTICALS

1) Study of different thallus forms of algae: Cyanophyceae, Chlorophyceae, Phaeophyceae and Rhodophyceae through specimens/photographs.

2) Study on local algal biodiversity through temporary mounts.

3) Identification of various types of fungi through temporary mounts/photographs.

4) Identification of various types of Lichens.

5) Identification of various types of Bryophytes using specimens/photographs.

6) Identification of various types of Pteridophytes using specimens/photographs.

7) Identification of various types of Gymnosperms with the help of specimens/photographs.

8) Identification of various forms of angiosperms with reference to monocots and dicots from the local area.

9) Electron micrographs/Models of viruses - T-Phage and TMV, Line drawing/Photograph of Lytic and Lysogenic Cycle.

10) Types of Bacteria from temporary/permanent slides/photographs, electron micrographs of bacterial reproduction, Binary Fission, Conjugation.

Suggested Readings

1. Lee, R.E. (2008). Phycology, Cambridge University Press, Cambridge. 4th edition.

2. Prescott, L.M., Harley J.P., Klein D. A. (2005). Microbiology, McGraw Hill, India. 6th edition.

3. Kumar, H.D. (1999). Introductory Phycology. Affiliated East-West Press, Delhi.

4. Sahoo, D. (2000). Farming the ocean: seaweeds cultivation and utilization. Aravali

International, New Delhi.

5. Campbell, N.A., Reece J.B., Urry L.A., Cain M.L., Wasserman S.A. Minorsky P.V., Jackson R.B. (2008). Biology, Pearson Benjamin Cummings, USA. 8th edition.

6. Pelczar, M.J. (2001) Microbiology, 5th edition, Tata McGraw-Hill Co, New Delhi.

7. Vashistha, P.C., Sinha, A.K., Kumar, A. (2010). Pteridophyta. S. Chand. Delhi, India.

8. Bhatnagar, S.P. & Moitra, A. (1996). Gymnosperms. New Age International (P) Ltd Publishers, New Delhi, India.

9. Parihar, N.S. (1991). An introduction to Embryophyta: Vol. I. Bryophyta. Central Book Depot. Allahabad

10. Gifford, E.M. (1989). Morphology and evolution of vascular plants (No. 04; QK641, G5 1989).

Course Title: Principles and techniques in Plant Sciences

Course code: Credit: 4
Maximum marks: 100 Total teaching hours: 60 (45 theory + 15 lab)

Course objectives

This course aims to teach various experimental techniques, equipment and chemicals used in biological laboratories. Students will also be able to identify different types of glassware and equipment used in biological laboratories. They can apply and use the biological devices more professionally.

Learning outcomes

After the successful completion of this module students will be able to:

1) Explain biological techniques that deal with the classical and recent techniques for studying biological structures.
2) Gain the knowledge and expertise in handling biological instruments.
3) Learn about the various types of micro techniques, preparation of plant material for sectioning, staining and permanent mounting.
4) Perform separation techniques used for molecular separation and analysis.
5) Know the various spectroscopic and sedimentation techniques.

THEORY

Unit I: Laboratory set-up

Working and application of magnetic stirrer, distillation unit, laminar air flow, autoclave, colorimeter and spectrophotometer

Importance and methods of sterilization, Media preparation - solid and liquid media, simple and complex media. nutrient agar slabs, slants and plates. Inoculation techniques - streak plate, pour plate and spread plate method, cultivation chambers, culture transfer techniques, pure culture techniques, Importance of laboratory record maintenance (Filing, orderly arrangement, date of manufacturing, storage temperature)

Unit II: Histology

Mechanism of fixation, types of fixatives, tissue dehydration – general protocol, rapid dehydration and dehydration using a graded solvent series of ethanol or acetone, infiltrating and embedding tissues, sectioning, mounting and staining (safranine, cotton blue, acetocarmine, iodine) alternate methods of microtomy: cryotome and vibratome. Localisation techniques: Immunolocalisation and GUS staining

Unit III: Microscopy and centrifugation

Introduction to optics, principles of image formation, magnifiers and microscopes, types of microscopes: simple and compound, bright field and dark field, confocal and deconvolution, phase contrast, fluorescence microscopy, electron microscopes – Brief concepts of SEM and TEM.

Basic principles of sedimentation – Types of preparative and analytical centrifugation

Unit IV: Chromatography and electrophoresis

Chromatography – Principles, chromatographic performance parameters, thin layer chromatography, partition chromatography, ion-exchange chromatography, gas chromatography, high performance liquid chromatography.

Electrophoresis – General principles, support media, electrophoresis of proteins and nucleic acids, capillary, agarose and sodium dodecyl sulfate polyacrylamide gel electrophoresis

PRACTICALS

1) To identify different glassware used in laboratory for experimentation.
2) To study the parts of dissection and compound microscope.
3) To prepare various stains and chemicals used in biological experiments.
4) To prepare the permanent slide using microtome and double staining.
5) To prepare standard curve using spectrophotometer.
6) To perform agarose gel electrophoresis of a given DNA sample.
7) To separate given material using a centrifuge.
8) To separate chlorophyll A and chlorophyll B using paper chromatography.
9) To study the sculpturing of pollen and seed coat through scanning electron microscopy.
10) To preserve the plant samples (Algae, Bryophytes, Pteridophytes, Gymnosperms and Angiosperms) in various preservatives.

Suggested Readings

1) Wilson, K., Hofmann, A., Walker, J.M. and Clokie, S. eds., 2018. *Wilson and Walker's principles and techniques of biochemistry and molecular biology*. Cambridge University Press.
2) Skoog, D.A., Holler, F.J. and Crouch, S.R., 2017. *Principles of instrumental analysis*. Cengage learning.
3) Hunt, L., Koenders, A. and Gynnild, V., 2012. Assessing practical laboratory skills

in undergraduate molecular biology courses. *Assessment & Evaluation in Higher Education*, *37*(7), pp.861-874.

Course Title: Mushroom cultivation

Course code: BOTICOO3T **Credits:2**

Maximum marks: 100 **Total teaching hours: 60**

Course objectives:

The objective of this course is to acquaint students with detailed techniques involved in mushroom farming. This will help them in self-employment and increase their chances of getting employed in the mushroom industry. The course deals with growing edible mushrooms. This includes culture preservation, basic mushroom substrate preparation, composting, spawning techniques, inoculation methods and mushroom harvesting. Students will understand the principles of mushroom cultivation, acquire practical knowledge of growing mushroom.

Learning outcomes

On completion of the course, students are able to:

1) Take up mushroom cultivation and run it profitably.
2) Make a selection of important types of mushrooms and their cultivation.
3) Maintain mushroom farms in a hygienic and scientific way.

THEORY

Unit I: Introduction to Mushrooms

History, production and uses of mushrooms; classification, categorization and diversity of mushrooms, nutritional and medicinal properties of mushrooms, wild mushrooms of Jammu and Kashmir (J&K), some important mushrooms available in local markets in J&K

Unit II: Mushroom cultivation and production

Design and development of mushroom production units; role of composting in mushroom cultivation, mushroom-spawn; culture maintenance, production of good quality spawn, preparation of pure culture, criteria for selection of good quality spawn, transportation of spawn, casing and case, cropping and harvesting of mushroom

Unit III: Post-harvest processing and merchandising mushrooms

Management of used substrates and waste disposal of various mushrooms, quality assurance, shelf life, processing and packaging, market opportunities, post-harvest handling, entrepreneurial skills and economics for small enterprise, importance of self-

employment, economics of different types of mushrooms, market survey, calculation of cost benefit ration of mushroom production

Suggested Readings

1) Mushroom Cultivation, Tripathi, D.P. (2005) Oxford & IBH Publishing Co. PVT.LTD, New Delhi. Reference Books:
2) Mushroom Production and Processing Technology, Pathak Yadav Gour (2010) Published by Agrobios (India).
3) A hand book of edible mushroom, S.Kannaiyan& K.Ramasamy (1980). Today & Tomorrows printers & publishers, New Delhi
4) Handbook on Mushrooms, Nita Bahl, oxford & IBH Publishing Co

Course Title: Economic Botany

Course code: IBOTIC005T
Maximum marks: 100

Credits: 4
Total teaching hours: 60

Course objectives

This course will teach students about the various uses of plants and plant products by humans. Students will also learn the taxonomic diversity of useful plants and they will be able to recognize geographical, historical and cultural differences in the use and importance of plants. The other portion of this course is intended to disseminate scientific information of the traditional knowledge and customs of a people concerning plants and their medical, religious, and other uses.

Learning outcomes

After completion of course students will be able to:

1) Get an overview on different types of plants used for economic purposes.
2) Recognize members of the major angiosperm families by identifying their diagnostic features and economic importance.

THEORY

Unit I: Plants as part of human culture

Origin and role of agriculture in shaping human history, Centres of origin of plants by Vavilov, Evolution of plants during domestication and production of new varieties

Unit II: Food, Spices, Beverages and Medicinal plants

Origin, morphology and uses of cereals (rice, wheat and maize): pulses (gram, soybean and pea); vegetables (potato, tomato and onion); spices (ginger, turmeric and cloves) and beverages (tea and coffee). Processing of tea and coffee. General features and uses of medicinal plants (*Cinchona*, *Rauwolfia*, *Atropa*, *Catharanthus*, *Papaver*, *Cannabis* and *Azadirachta*)

Unit III: Fruits, Nuts, Timber and Fibres

Origin, morphology and uses of fruits (Apples, Banana and Mango) and nuts (Almond, Walnut and Cashew nut). Botanical description and uses of timber (Teak, Bamboo and Deodar); oils (Groundnut, Olive, Mustard and Coconut); essential oils (Rose and Lemon grass); fibres (Cotton, Jute and Flax)

Unit IV: Rubber, Sugar and Importance of lower Plants and Microbes

Rubber (*Hevea brasilensis* and *Ficus elastica*) and sugar (sugarcane and sugar beet).

Utilization of algae, fungi, lichens, bryophytes and pteridophytes in agriculture, in medicine and as food products. Their role in nitrogen fixation, treatment of waste and as pollution indicators

PRACTICALS

1. Cereals: Study of habit, L.S./T.S. of grain, starch grains and microchemical tests of rice and wheat.

2. Legumes: Study of habit, fruit, seed structure, micro-chemical tests of pea and groundnut.

3. Sugars: Study of habit of sugar cane and sugar beet.

4. Spices: Study of habit and sections of black pepper, fennel, clove and cumin seeds.

5. Beverages: Study of morphology of tea and coffee plants.

6. Oils and Fats: Coconut - T.S. of mature fruit, Mustard - plant and seed morphology and microchemical tests of crushed seeds.

7. Essential oil yielding plants: Study of morphology of *Rosa*, *Vetiveria*, *Cymbopagon*, *Santalum* and *Eucalyptus* (specimens/photographs).

8. Rubber: Study of plant morphology using specimen or photograph, model of tapping. samples of rubber products.

9. Drug-yielding plants: Study of specimens of *Digitalis*, *Rauwolfia*, *Papaver* and *Cannabis*.

10. Woods: Study of specimens and sections of young stem of *Tectona*, *Dalbergia sisso* and *Pinus*.

11. Fiber yielding plants: Cotton (specimen, whole mount of seed to show lint and fuzz fibers, whole mount of fiber and test for cellulose), Jute (specimen, test for lignin on transverse section of stem and fiber).

Suggested Readings

1. Kochhar, S.L. (2012). Economic Botany in Tropics, MacMillan & Co. New Delhi, India.

2. Wickens, G.E. (2001). Economic Botany: Principles & Practices. Kluwer Academic Publishers, The Netherlands.

3. Chrispeels, M.J. and Sadava, D.E. (2003). Plants, Genes and Agriculture. Jones & Bartlett Publishers.

Course Title: **Fundamentals of Biochemistry**

Course code: **Credits: 4**

Maximum marks: 100 **Total teaching hours: 60**

Course objectives

This course aims to provide students with an understanding of biomolecules, with an emphasis on their structural foundations, unique properties, biological roles and functions, and inter-relationships. The focus is on the structural and functional relationships of various biomolecules at the chemical level from a biological point of view.

Learning outcomes

After the completion of this course students will be able to:

1) Describe the chemistry of carbohydrates, lipids, proteins and amino acids.

2) Describe the classification and structural organization of carbohydrates, lipids, proteins, nucleotides and nucleic acids and utilize the knowledge for getting employed in pharmaceutical industries.

THEORY

Unit I: Foundation of Biochemistry

The fundamentals of biochemistry, Cellular and chemical foundations of life; Water: unique properties, weak interactions in aqueous systems, ionization of water, buffering action in biological system, water as a universal solvent, reactant and fitness of the aqueous environment

Unit II: Carbohydrate

Monosaccharides - structure of aldoses and ketoses; Ring structure and conformation of sugars mutarotation, anomers, epimers and enantiomers; Structure of biologically important sugar derivatives, oxidation and reduction of sugars; Formation of disaccharides, reducing and non-reducing disaccharides; Polysaccharides – homo- and heteropolysaccharides, structural and storage polysaccharides; Structure and role of glycoconjugates - proteoglycans, glycoproteins and glycolipids (gangliosides and lipopolysaccharides); Carbohydrates as informational molecules

Unit III: Amino acids, proteins and Lipids

Amino Acids; Structural features and classification; physical properties, chemical

properties (acid base properties, titration curve); Uncommon amino acids and their functions; Proteins: primary, secondary and tertiary structures and function of proteins Lipids: building blocks of lipids - fatty acids, glycerol, ceramide; Storage lipids - triacyl glycerol and waxes; Structural lipids in membranes – glycerophospholipids; Galactolipids and sulpholipids, etherlipids, sphingolipids and sterols; their distribution and role of. Plant steroids; Lipids as signals, cofactors and pigments

Unit IV: Nucleotides and Nucleic acid

Nucleic Acids: Nucleotides - structure and properties of bases, pentoses; nucleosides; Watson-Crick model of DNA; forms and structure of DNA; Watson-Crick model of DNA; Structure of major species of RNA - mRNA, tRNA and rRNA; Other functions of nucleotides - source of energy, component of coenzymes and second messengers; Enzymes; classification and mode of action

PRACTICALS

1) Safety measures in laboratories.
2) Preparation of normal and molar solutions.
3) Preparation of buffers, phosphate and acetate buffers.
4) Determination of pKa of acetic acid and glycine.
5) Qualitative tests for carbohydrates.
6) Qualitative test for lipids.
7) Qualitative test for amino acids, proteins.
8) Qualitative test for nucleic acids.
9) Separation of amino acids/ sugars/ bases by thin layer chromatography/paper chromatography.

Suggested Readings

1. Campbell, MK (2012) Biochemistry, 7th ed., Published by Cengage Learning

2. Campbell, PN and Smith AD (2011) Biochemistry Illustrated, 4th ed., Published by Churchill Livingstone

3. Tymoczko JL, Berg JM and Stryer L (2012) Biochemistry: A short course, 2nd ed., W.H.Freeman 4. Berg JM, Tymoczko JL and Stryer L (2011) Biochemistry, W.H.Freeman and Company

5. Nelson DL and Cox MM (2008) Lehninger Principles of Biochemistry, 5th Edition., W.H. Freeman and Company.

6. Karp, G. (2010). Cell Biology, John Wiley & Sons, U.S.A. 6th edition.

7. Hardin, J., Becker, G., Skliensmith, L.J. (2012). Becker's World of the Cell, Pearson Education Inc. U.S.A. 8th edition.

8. Cooper, G.M. and Hausman, RE. 2009 The Cell: A Molecular Approach. 5th edition. ASM Press & Sunderland. Washington, D.C.; Sinauer Associates, MA.

9. Becker, W.M., Kleinsmith, L.J., Hardin. J. and Bertoni, G. P. 2009 The World of the Cell. 7th edition. Pearson Benjamin Cummings Publishing, San Francisco

Course title: Processing of plant-based products

Course code: **Credits:3**

Maximum marks: **Maximum teaching hours:**

Course Objectives: The course aims to make the students competent in processing and preservation techniques of fruits and vegetables. Besides, students will gain the knowledge of food safety and quality management.

Learning outcomes

After the successful completion of this module students will be able to:

1) Evaluate and rank foods with regard to their degree of processing.
2) Depict the steps involved in processing of common fruits and vegetables for their economic use.
3) Explain the health, social and economic concerns associated with the food processing industry.
4) Set-up their own food processing fruits and vegetables units or contribute to the already existing one

THEORY

Unit I: Fruit and vegetable processing

Status of Indian food industry with emphasis on Jammu and Kashmir; nutritional significance of fruits and vegetables; need and scope for processing of fruits and vegetables; Production of fruits and vegetables in India and J&K; Introduction to national and international food laws; Food safety and standards Act-2006; FSSAI rules and regulation

Unit II: Post-harvesting changes and storage of fruits and vegetables

Maturity and ripening of fruits and vegetables; post-harvest physiology and wastage of fruits and vegetables; Storage of fruits and vegetables; Refrigerated and controlled atmospheric storage. Packaging- definition, functions; and requirements of fruits & vegetables; drying, dehydration, freezing and canning of fruits and vegetables

Unit III: Fruits and vegetable products

Selection of raw material - Suitability of various fruits and vegetables, for processing; technology for production of processed products of fruits and vegetables (jam, jelly, marmalade, juice, nectar, candy, sauce, chutney and pickles); specifications of various fruit

and vegetable products according to FSSAI; tomato products-juice, paste, puree, ketchup, cocktail. Requirements and project formulation for a fruit and vegetable-based processing plant

Suggested Readings:

1. Home Scale Preservation of Fruits and Vegetables- CFTRI Lab Manual.
2. The Technology of Food Preservation by Desrosier
3. Potter, N.N. and Hotchkiss, J.H., 2012. *Food science*. Springer Science & Business Media.
4. Qadri, O.S., Yousuf, B. and Srivastava, A.K., 2015. Fresh-cut fruits and vegetables: Critical factors influencing microbiology and novel approaches to prevent microbial risks—A review. *Cogent Food & Agriculture*, *1*(1), p.1121606.
5. Verma, L.R. and Joshi, V.K., 2000. Postharvest technology of fruits and vegetables: handling, processing, fermentation and waste management. Volume 2: Technology. *Postharvest technology of fruits and vegetables: handling, processing, fermentation and waste management. Volume 2: Technology.*

Course title: Introduction to Plant Biology

Course code: 1BOT10 001T
Maximum marks: 100

Credit: 4
Total teaching hours: 60

Course objectives

This course is aimed to expose students to basic knowledge of biology. It will deal with the life processes including germination, growth, anatomy and differentiation, physiology and metabolism, flowering and fruiting, and biological interactions.

Learning outcomes

After completion of course students will be able to describe and appreciate

1) The history of plant biology.
2) Structure and functions of various parts of plants.
3) Types of plant cells and their structure and functions.
4) Principles of genetics, physiology and interaction of plants.

THEORY

Unit I: History of plant sciences

Origin and evolution of botany as a science, History and development of Botany in India and abroad, domestication and origin of agriculture, plants and people.

Unit II: The Structure of Plants

Concept of Monocots and dicots- Important characteristics of each; vegetative organs of plants-root, stem and leaf, their structure, modification and functions. Reproductive organs of plants - diversity in inflorescence and flower structure

Unit III: Plant physiology and development

Photosynthesis and Respiration, brief account of transport processes (active and passive), water and mineral nutrition

Unit IV: Genetics and Plant Breeding

Mendel's genetic experiments on pea, definition of gene and allele; dominant and recessive; phenotype and genotype; homozygous and heterozygous; monohybrid and dihybrid crosses, backcross and test cross; incomplete dominance and co-dominance, a brief introduction to pure lines; concept of in breeding depression and heterosis; hybridization and hybrid varieties

Unit V: Plant ecology and conservation

Ecosystem and its components; definition of population, community, food chain and food

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webs; Extinction- human and natural impacts; concepts of RET taxa, hotspots and red data book; brief idea of conservation approaches

Suggested Readings

1. Dickison, W.C. (2000). Integrative Plant Anatomy. Harcourt Academic Press, USA.
2. Fahn, A. (1974). Plant Anatomy. Pergmon Press, USA.
3. Mauseth, J.D. (1988). Plant Anatomy. The Benjammin/Cummings Publisher, USA.
4. Esau, K. (1977). Anatomy of Seed Plants. John Wiley & Sons, Inc., Delhi.
5. Karp, G. (2010). Cell Biology, John Wiley & Sons, U.S.A. 6th edition.
6. Hardin, J., Becker, G., Skiiensmith, L.J. (2012). Becker's World of the Cell, Pearson Education Inc. U.S.A. 8th edition.
7. Griffiths, A.J.F., Wessler, S.R., Carroll, S.B., Doebley, J. (2010). Introduction to Genetic Analysis. W. H. Freeman and Co., U.S.A. 10th edition
8. Odum, E.P. (2005). Fundamentals of ecology. Cengage Learning India Pvt. Ltd., New Delhi. 5th edition.
9. Singh, J.S., Singh, S.P., Gupta, S. (2006). Ecology Environment and Resource Conservation. Anamaya Publications, New Delhi, India.

Course Title: Vermicomposting and Mushroom farming

Course code:

Credits:4

Maximum marks: 100

Total teaching hours: 60

Course objectives:

The objective of this course is to acquaint students with detailed techniques involved in vermicomposting and mushroom cultivation. This will help them in self-employment and increase their chances of getting employed in the mushroom industry. The course also deals with growing edible mushrooms. This includes culture preservation, basic mushroom substrate preparation, composting, spawning techniques, inoculation methods, mushroom harvesting and pest control. Students will understand the principles of mushroom cultivation, acquire practical knowledge of growing mushroom.

Learning outcomes

On completion of the course, students are able to:

1) Explain the potential of vermicompost as an alternative to chemical fertilizers.
2) Explain the role of vermiculture in maintaining the health of soil and humans.
3) Identify business opportunities in chosen sector / sub-sector and plan and market and sell products / services.
4) Start and manage a small business enterprise by liaising with different stake holders.
5) Take up mushroom cultivation and run it profitably.
6) Make a selection of important types of mushrooms and their cultivation.
7) Maintain mushroom farms in a hygienic and scientific way.

THEORY

Unit I: Introduction to vermiculture

Definition, history, and economic importance of vermiculture, Choice of the right worm, Local –and exotic species of earthworms, choice of right worm, Vital cycle of earthworm: alimentation, fecundity, annual reproducer potential. Limiting factors (gases, diet, humidity, temperature, pH, light, and climatic factors)

Unit II: Methods of vermicultu

Earthworm farming (Vermiculture), extraction, vermicomposting harvest, processing, transport and storage. Physico- chemical parameters of vermicompost, different methods of vermicomposting - Small- and large-scale bed and pit methods. Small scale earthworm farming and earthworm compost - Earthworm compost for home gardens. Conventional commercial composting; some important pests and diseases of earthworms and their management. Nutritional composition of vermicompost and comparison with other fertilizers, transport and storage of vermicompost

Unit III: Introduction to Mushrooms

History, production and uses of mushrooms; classification, categorization and diversity of mushrooms, nutritional and medicinal properties of mushrooms, wild mushrooms of Jammu and Kashmir (J&K), some important mushrooms available in local markets in J&K

Unit IV: Mushroom cultivation and production

Design and development of mushroom production units; role of composting in mushroom cultivation, mushroom spawn; culture maintenance, production of good quality spawn, preparation of pure culture, criteria for selection of good quality spawn, transportation of spawn, casing and case, cropping and harvesting of mushroom

Unit V: Disease management in mushroom cultivation and post-harvest survey

–Major pests affecting mushrooms, flies/ nematodes/mites; their identification and management by chemical and non -chemical methods, Major diseases of cultivated mushrooms, Competitor/weed molds: Green, yellow and plaster molds

Suggested Readings

1. Bhatt J.V. & S.R. Khambata (1959) "Role of Earthworms in Agriculture" Indian Council of Agricultural Research, New Delhi
2. Dash, M.C., B.K.Senapati, P.C. Mishra (1980) " Verms and Vermicomposting" Proceedings of the National Seminar on Organic Waste Utilization and Vermicomposting Dec. 5-8, 1984, (Part B), School of Life Sciences, Sambalpur University, Jyoti Vihar, Orissa.
3. Edwards, C.A. and J.R. Lofty (1977) "Biology of Earthworms" Chapman and Hall Ltd., London.
4. Lee, K.E. (1985) "Earthworms: Their ecology and Relationship with Soils and Land

Use" Academic Press, Sydney.

5. Kevin, A and K.E.Lee (1989) " Earthworm for Gardeners and Fisherman" (CSIRO, Australia, Division of Soils)
6. Rahudakar V.B. (2004). Gandul khatashivay Naisargeek Paryay, Atul Book Agency, Pune.
7. Satchel, J.E. (1983) "Earthworm Ecology" Chapman Hall, London.
8. Wallwork, J.A. (1983) "Earthworm Biology" Edward Arnold (Publishers) Ltd. London.
9. Mushroom Cultivation, Tripathi, D.P. (2005) Oxford & IBH Publishing Co. PVT.LTD, New Delhi. Reference Books:
10. Mushroom Production and Processing Technology, Pathak Yadav Gour (2010) Published by Agrobios (India).
11. A hand book of edible mushroom, S.Kannaiyan& K.Ramasamy (1980). Today & Tomorrows printers & publishers, New Delhi
12. Handbook on Mushrooms, Nita Bahl, oxford & IBH Publishing Co

Course title: Climate change and disaster management

Course code: **Credits: 4**

Maximum marks: 100 **Maximum teaching hours:**

Course objectives

This course will explain the key scientific concepts of cases and symptoms of global climate change. Impact of global climate change on ecosystems and human society will be studied. The other portion of the course will provide a basic conceptual understanding of the relationship between disasters and their development.

Learning outcomes

After the successful completion of this module students will be able to:

1) Explain the physical basis of the natural greenhouse effect, and the ways various human activities are increasing emissions of the natural greenhouse gases.
2) Develop a sound understanding of disaster risk and related underlying factors, their impact.
3) Appreciate and comprehend on approaches and measures of disaster management, preparedness and response, and related policies, laws and methods.
4) Explain various pathways, tools and entry points for integrating CCA-DRR and sustainability concerns into developmental planning across sectors, national, subnational and local plans and actions of DM.

THEORY

Unit I: Climate change

Concepts of climate, weather, greenhouse effect; greenhouse gases - Role of Carbon- di-oxide and methane, El Niño and La Nina effects, ocean circulation, the science and politics of global warming and climate change impacts on Indian subcontinent, carbon reservoir, biogeochemistry ,carbon footprints. Carbon Cycling: The physical carbon pump, biological carbon pump, marine carbon cycle, terrestrial carbon cycle. Global Wind Systems - Trade winds and The highs and lows of the westerlies. The Vital Importance of monsoon rains, global warming and IPCC

Unit II: Definition and types of disaster

Brief account of hazards and disasters; Risk and vulnerability in disasters; Natural and man-

made disasters: earthquakes, floods, drought, landslide, land subsidence, cyclones, volcanoes, hurricanes, tsunami, avalanches, global climate extremes, terrorism, gas and radiations leaks, toxic waste disposal, oil spills, forest fires

Unit III: Disaster risks

Study of important disasters; Earthquakes and its types, magnitude and intensity, seismic zones of India, major fault systems of Indian plate; management of floods, drought and landslides case studies of disasters in Jammu and Kashmir and Sikkim [(e.g) Earthquakes, Landside]. Social, economic and environmental impact of disasters. Concept of disaster risk governance, climate change adaptation, disaster risk assessment and infrastructure and IDB's investment projects.

Unit IV: Qualitative and quantitative risk analysis

Key concepts related to qualitative and quantitative risk analysis, determination and measurement of the impact and probability of the main risks and their effects on infrastructure projects. Tools for the representation of risk (F-N and F-D curves), technical and economic feasibility; investment alternatives, quantitative indicators, principles of efficiency and equity, components of risk governance

Unit V: Mitigation and management techniques of disaster

Basic principles of disasters management, disaster management cycle, disaster management policy, national and state bodies for disaster management, early warning systems, building design and construction in highly seismic zones, retrofitting of buildings; training and awareness program, project on disaster management; training and drills for disaster preparedness; awareness programs, Usages of GIS and remote sensing techniques in disaster management.

Suggested Readings:

1) Cambridge University (2013). Climate Change: Action, Trends and Implications for Business. IISD, UNITAR & UNEP (2009). IEA Training Material: Vulnerability and Climate Change Impact Assessment for Adaptation.
2) IPCC (2013). Climate Change 2013. The Physical Science Basis - Summary for Policymakers. OECD (2009): Guidance on Integrating Climate Change Adaptation into Development Co-operation.
3) UNEP (2009). Climate Change Science Compendium
4) UNEP (2009). Climate in Peril, a Popular Guide to the Latest IPCC Report.
5) UNEP & UNDP (2011). Mainstreaming Climate Change Adaptation into

Development Planning: A Guide for Practitioners.
6) UNFCCC. CGE Climate Change Training Materials.
7) UNFCCC (2008). Compendium on Methods and Tools to Evaluate Impacts of, and Vulnerability and Adaptation to Climate Change.
8) UNFCCC (2006). UNFCCC Handbook.
9) UNFCCC & UNEP (2002). Climate Change Information Kit.
10) World Bank Report (2012). Turn Down the Heat.

Course title: Biostatistics and R-programing

Course code:	Credits:4
Maximum marks: 100	Maximum teaching hours:

Course Objectives

The present course will apprise students about the methods and principles necessary for understanding computing, analysing and interpreting data. The use and importance of R for analytical programming will further strengthen the computing skills of students.

Learning outcomes

After the successful completion of this module students will be able to:

1) Install, code and use R programming language in R studio IDE to perform basic tasks on vectors, matrices and data frames.
2) Describe key terminologies, concepts and techniques employed in statistical analysis.
3) Define, calculate, implement probability and probability distributions to solve a wide variety of problems.
4) Conduct and interpret a variety of hypothesis tests to aid decision making.
5) Analyse, interpret correlation and regression to comprehend the underlying relationships between different variables.

THEORY

Unit I: Elementary concepts in Statistics

Concepts of statistical population and sample from a population; Types of data-qualitative and quantitative data; nominal, ordinal, ratio, interval data; cross sectional and time series data; discrete and continuous data. Collection and scrutiny of data: Primary data; designing a questionnaire and a schedule; secondary data and sources of secondary data. Descriptive statistics: Concepts of central tendency or location, Absolute and relative measures of dispersion

Unit II: Probability

Random Experiment; sample point; sample space; Events- mutually exclusive and exhaustive events; dependent and independent events; simple and compound events; equally likely frequency, classical and axiomatic definition of probability; addition and multiplication theorems; conditional

probability and independence; Bayes' theorem. (The main thrust is on numerical problems and applications), Discrete and continuous random variables; probability mass and density functions and distribution functions; expectation of a random variable

Unit III: Standard univariate distributions

Standard univariate discrete and continuous distributions- uniform; binomial; Poisson; geometric; negative binomial and hyper-geometric distributions. Uniform; exponential; normal; Laplace, gamma, beta, lognormal, logistic and Weibull distributions (elementary properties and applications only)

Unit IV: Basics of R programming

Fundamentals of R; Installation of R & R Studio; Features of R; Variables in R; Constants in R; Operators in R; Datatypes and R Objects; Accepting Input from; keyboard; Important Built-in functions; Vectors; Control statements; Functions in R; Creating matrices; Accessing elements of a Matrix; Operations on Matrices; Matrix transpose; Strings; Lists; Arrays in R; Importing Data- CSV files; Database data (Oracle 11g); XML files; JSON files; Reading & Writing PDF files; Reading & Writing JPEG files; Saving Data in R

Unit V: R programing in analysis

Statistical Concepts-Descriptive Statistics; Inferential Statistics; Central Tendency (Mean. Mode, Median); Hypothesis Testing; Probability; t-Test; z-Test; Chi Square test; Correlation: Covariance; Anova; Predictive Modelling Linear Regression; Normal distribution; Density; Data Visualisation in R using G G Plot; Box Plot: Histograms; Scatter Plotter; Line chart; Bar Chart; Heat maps; Data Visualization using Plotly - 3D-view: Geo Maps; Null Handling; Merge; Grep; Scan

Suggested Readings

1. Biostatistic, Danniel, W.W., 1987.New York, John Wiley Sons.
2. An introduction to Biostatistics, 3rd edition, Sundarrao, P.S.S and Richards, J. Christian Medical College, Vellore.
3. Statistical Analysis of epidemiological data, Selvin, S., 1991. New York University Press.
4. Statistics for Biology, Boston, Bishop, O.N. Houghton, Mifflin.
5. The Principles of scientific research, Freedman, P. New York, Pergamon Press.
6. Introduction to Statistics and Data Analysis - With Exercises, Solutions and Applications in R By Christian Heumann, Michael Schomaker and Shalabh, Springer, 2016.
7. The R Software-Fundamentals of Programming and Statistical Analysis -Pierre Lafaye

de Micheaux, Rémy Drouilhet, Benoit Liquet, Springer 2013.

8. A Beginner Guide to R (Use R) By Alain F. Zuur, Elena N. Ieno, Erik H.W.G. Meesters, Springer 2009.