



हिमाचल प्रदेश केंद्रीय विश्वविद्यालय
Central University of Himachal Pradesh
(Established under Central Universities Act 2009)
अस्थायी शैक्षणिक खण्ड, शाहपुर, जिला कांगड़ा, हिमाचल प्रदेश - 176206
Temporary Academic Block, Shahpur, Distt. Kangra (HP) - 176206
Website: www.cuhimachal.ac.in

Pre Ph.D. Course in Plant Sciences (Botany)

Scheme of Courses for Pre Ph.D. Course in Plant Sciences (Botany)

Course Code	C/E*	Course Name	Credits
CPE-RPE	C	Research and Publication Ethics	2
PLS-600	C	Advances in Research Methodology	4
PLS-ITK	C	Indian Traditional Knowledge and practices	2
PLS-PTL	C	Pedagogy of teaching learning Process	2
PLS-601	E	Abiotic Stress Management in Plants	4
PLS-602	E	Greenhouse Technology for High Value Plants	4
PLS-603	E	Advanced Plant Biochemistry	4
PLS-604	E	Recent Techniques in Plant Sciences	4
PLS 605	E	Advanced Plant Biotechnology	4
PLS 606	E	"Omic" Approaches - Technologies and Applications	4

*Students can select any two elective papers from above scheme.

C- Compulsory

E- Elective

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Advances in Research Methodology (PLS-600)

Course Credit: 4

UNIT –I: Introduction to research design:

Definition of the Problem: Identifying and formulating the problem. Developing a research plan: Research objective: information required for solving the problem: defining each major concept in operational terms: an overall description of approach, clearly stating any assumptions.

UNIT –II: Scientific literature review

Reading and critical analysis of scientific literature/ research paper/case reports etc. Drafting and communicating research results in peer-reviewed journals. Acknowledgement of contributions, authorship issues; Intellectual Property Rights (IPR), scientific ethics, rules of plagiarism.

UNIT –III: Writing and presentation skills

Communication skills of research work through Poster and oral presentation Writing review paper on a relevant research topic and presentation of the same in a seminar /conferences / workshop / symposium etc.

UNIT –IV: Experimental Design and Data Analysis

Define sensitivity, accuracy, precision and specificity. The limits and range of measurement in different systems Experimental design; single and double blind studies, use of placebo in experiment Maintenance and storage of data, Concept of sampling, Positive and negative controls groups, biological and technical replicates in experiments Biostatistics: Correlation and Regression, Probability and Distributions, Principles of Hypothesis Testing, Significance, One Sample z-test, One Sample t-test, Two Sample z-test, Two Sample t-test, Chi-Square test, ANOVA. Factorial and transformation.

UNIT –V: Working in Laboratory

Good laboratory practice (GLP); Safety and bio- and radio- hazards, proper disposal of biological and chemical wastes Accuracy of liquid transfer in laboratory. Preparation of Reagents, chemicals, buffers for experiments General safety and precautions measures and its implementation during experiment. Handling of Instruments in the Central Instrumentation facility (CIF)

REFERENCES

1. Blum, Deborah and Mary Knudson, eds. A field guide for science writers: the official guide of the National Association of Science Writers, New York: Oxford University Press, 1997.
2. Booth, Wayne, Gregory G Colomb, Joseph M. Williams. The craft of Research Chicago University of Chicago Press, 1995.
3. Davis, Martha. Scientific Papers and Presentations. San Diego: Academic Press, 1997.
4. Fuscaldo, AA, Erlick, BI, Hindman, B. Laboratory Safety: Theory and Practice. New York: Academic Press, 1980.
5. Bajpai, PK. Biological Instrumentation and Methodology. New Delhi: S. Chand & Co. Ltd. 2006.,
6. Kothari, C. R. (2004). 2/e, Research Methodology- Methods and Technique.(New Age International, New Delhi)
7. Montgomery, Douglas C. and Runger, George C. (2007), 3/e. applied statistics and probability for Engineers. (Wiley, India)

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Abiotic stress management in plants (PLS-601)

Credits: 4

UNIT -I

Environmental stress and its types, soil parameters including pH, classification of plants based on susceptibility and tolerance to various types of stress; use of wild species as root stock, use of antitranspirants.

UNIT-II

Mechanism and measurements of tolerance to drought, water logging, soil salinity, frost and heat stress in plants

UNIT-III

Soil-plant-water relations under different stress conditions in plants and their management practices.

UNIT-IV

Techniques of growing plants under water deficit, water logging, salinity and sodicity.

UNIT-V

Techniques of growing plants under high and low temperature conditions, use of chemicals in alleviation of different stresses.

- I. Research papers and reviews published in peer-reviewed international journals in the above areas
II. Suggested Readings

1. Dwivedi P & Dwivedi RS. 2005. Physiology of Abiotic stress in Plants. Agrobios.
2. Lerner HR (Ed.). 1999. Plant Responses to Environmental Stresses. Marcel Decker.
3. Maloo SR. 2003. Abiotic Stresses and Crop Productivity. Agrotech Publ. Academy.
4. Parvaiz Ahmad, M.N.V. Prasad. Abiotic Stress Responses in Plants: Metabolism, Productivity and Sustainability
5. Hale, Maynard G and Orcutt David M. The physiology of plants under stress, Wiley Eastern Ltd., New Delhi
6. Levitt. Responses of plants to environmental stresses. Academic Press, New York and London

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Greenhouse technology for high value plants (PLS-602)

Credits: 4

UNIT -I

Importance and scope of greenhouse /protected cultivation, principle used in protected cultivation, energy management, low cost structure; training methods; engineering aspects

UNIT-II

Regulatory structure used in protected structure, types of greenhouses/polyhouse/net houses, hot beds, cold frames, effect of environmental factors, viz. temperature, light, CO₂ and humidity on growth of plants, manipulation of CO₂, light and temperature for greenhouse, fertigation

UNIT-III

Nursery raising in protected structures like poly-tunnels, types of benches and containers, different media for growing nursery under cover

UNIT-IV

Production technology of high value vegetables/flowers/medicinal/aromatic plants under greenhouse structures

UNIT-V

Problem of growing plants in protected structure and their remedies, insect and disease management in protected structure; soil-less culture, use of protected structures for seed production, Vertical farming/Hydroponics/Aeroponics/Grafting technologies

References:

1. Protected Cultivation of Vegetable Crops by Balraj Singh Kalyani Publ. 2006.
2. Cultivating Vegetables in Green House by Chandra S and Som V. Indian Horticulture 45: 17-18.
3. Green House Technology for Controlled Environment by G.N Tiwari. Narosa Publications.2003.
4. Practical Manual on Protected Cultivation by Parveen Sharma, Pardeep Kumar and N K Pathania.2014.

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Credits: 4

Advanced Plant Biochemistry (PLS-603)

UNIT-I

Structure, properties and functions of Carbohydrates, Structural polysaccharides cellulose and chitin, storage polysaccharides starch, glycogen, peptidoglycan and glycosaminoglycans, proteoglycans and glycoproteins,

UNIT-II

Glycolysis, kreb's cycle, Pentose phosphate pathway, glyoxylate cycle, glycogenolysis and glycogenesis, gluconeogenesis, Pyruvate Dehydrogenase and its regulation, TCA cycle, glyoxalate cycle, Electron Transport Chain, inhibitors and uncouplers of oxidative phosphorylation.

UNIT-III

Amino acids; Primary, secondary, tertiary & quaternary structure of proteins; post translational modifications. Structural organization of soluble & membrane proteins; structure-function relationships, Isolation, purification & characterization of proteins: Precipitation, fractionation & chromatographic methods.

UNIT-IV

Lipids: Classification of lipids and fatty acids. General Structure and function of major lipid subclasses, acylglycerols, phosphoglycerides, sphingolipids, glycosphingolipids and terpenes, sterols, steroids, Lipid metabolism: Biosynthesis of odd and even carbon saturated and unsaturated fatty acids, formation of ketone bodies, biosynthesis of triacylglycerols, membrane phospholipids, cholesterol and steroids.

UNIT-V

Nucleic Acids- Structure and functions: Structure and properties of purine and pyrimidine bases. Nucleosides and nucleotides. Biologically important nucleotides, Nucleic acid metabolism: Biosynthesis and break down of purine & pyrimidine nucleotide by de-novo and salvage pathway Vitamins and Hormones: their structure, properties and biological functions.

- I. Research papers and reviews published in peer-reviewed international journals in the above areas
- II. Text books
 1. Biochemistry 5th Edition Stryer Lubert (1995) or later WH Freeman & Co New York. USA.
 2. Nelson, D. L., Lehninger, A. L., & Cox, M. M. (2008). Lehninger Principles of Biochemistry. Macmillan.
 3. Biophysical Chemistry parts I through III (3 Book Series) by Charles Cantor and Paul R. Schimmel. W. H. Freeman and Co, New York City. NY, USA
 4. Biochemistry by Donald and Judith Voet: John Willey and Sons, Indian Edition.

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Recent Techniques in Plant Sciences (PLS-604)

Credits: 4

UNIT-I

Introduction, light microscope, Optical sectioning, Imaging living cells and tissues, phase contrast microscopy, fluorescent microscopy, scanning and transmission electron microscopy

UNIT-II

Principles of chromatography, Chromatographic performance parameters, Ion-exchange chromatography, Molecular (size) exclusion chromatography, Affinity chromatography, Gas and Liquid chromatography

UNIT-III

Introduction, Ultraviolet and visible light spectroscopy, Fluorescence spectroscopy, Circular dichroism spectroscopy, Light scattering, Atomic spectroscopy, Infrared and Raman spectroscopy, Nuclear magnetic resonance, X-ray diffraction, tandem mass spectrometry

UNIT-IV

Electrophoresis of proteins and nucleic acids, Capillary electrophoresis, Microchip electrophoresis, pulse field gel electrophoresis (PFGE) and 2-Dimensional gel electrophoresis, Blotting techniques: Southern, Northern, Western, DNA fingerprinting

UNIT-V

Cell sorting, Hybridoma technology, Plant derived antibodies, Histochemical and Immuno-techniques, Immunochemical Techniques, Radioimmunoassay (RIA), Enzyme Linked Immunosorbent Assay (ELISA) and Autoradiography, Visit to nearby institute for instrumentation facilities

I. Research papers and reviews published in peer-reviewed international journals in the above areas

II. Recommended Books:

1. Wilson, K., & Walker, J. (Eds.). Principles and techniques of biochemistry and molecular biology. Cambridge university press.
2. Sawhney, S. K., and Randhir Singh, eds. Introductory practical biochemistry. Alpha Science Int'l Ltd.
3. Skoog, D. A., & West, D. M. Principles of Instrumental Analysis, (Saunders golden sunburst series).
4. Bajpai, P. K. Biological Instrumentation and Methodology (Tools and Techniques of Biology). S. Chand Publishing.
5. Sheehan, D. Physical biochemistry: principles and applications. John Wiley & Sons.
6. Van Holde, K. E., Johnson, W. C., & Ho, P. S. Principles of physical biochemistry.
7. Singh, B. D., and B. D. Singh. Biotechnology expanding horizons. Kalyani publishers.

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Course Name: Advanced Plant Biotechnology (PLS 605) (Total Credits - 04)

UNIT-I

Cell and tissue culture: Plant tissue culture media, Role of plant growth regulators in tissue culture, Micropropagation techniques: Somatic embryogenesis, Synthetic seeds, Anther, pollen and ovary culture

UNIT-II

Protoplast culture and Somatic hybridization, Cryopreservation, Suspension cultures, Hairy root culture, Plant Bioreactor types for cell and tissue culture, Introduction to Hydroponics and Aeroponics grow systems

UNIT-III

Enzymes and vectors used in genetic engineering, Construction of Genomic and cDNA libraries, Introduction to PCR, Reverse transcriptase-PCR and Real Time PCR, Blotting techniques

UNIT-IV

Methods of Plant Transformation: Direct and Indirect, Plant transformation vector, T-DNA and viral vector, Agrobacterium mediated gene transfer, Particle bombardment, Electroporation and Microinjection, Selection of transgenics: selectable marker and reporter genes

UNIT-V

Emerging trends involved in metabolic engineering for the enhancement of bioactive compounds: High throughput sequencing/GWAS, Gene editing using CRISPR/Cas9, Upregulation / Downregulation of genes involved in various metabolic pathways

Suggested Readings

1. Bhojwani, S.S. and Razdan, M.K., (1996). Plant Tissue Culture: Theory and Practice. Elsevier Science Amsterdam. The Netherlands.
2. Glick, B.R., Pasternak, J.J. (2003). Molecular Biotechnology- Principles and Applications of recombinant DNA. ASM Press, Washington.
3. A. Skater, N.W. Scott and M.R. Fowler (2008). Plant Biotechnology. Second Edition. Oxford.
4. N. Santosh and A. Madhavi. (2010). Practical Book of Biotechnology and Plant Tissue Culture. S. Chand & Co.
5. Plant Biotechnology and Genetics: Principles, Techniques and Applications by C.Neal Stewart (Wiley Publisher, 2008)
6. Plant Genetic Engineering by A.D. Arencibia, 1st Edition Volume 5, Elsevier Science, 2000
7. Frederic P. Miller, Agnes F. Vandome, John McBrewster: AEROPONICS by Alphascript Publishing, 2009
8. Hydroponics: A Practical Guide for the Soilless Grower (2nd Edition), by Dr. J. Benton Jones

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“Omic” Approaches - Technologies and Applications (PLS 606)

Credit: 4

Objectives

Regarding knowledge and understanding

- To explain different hereditary patterns; describe different approaches at to identify disease genes a basic level,
- To explain different methods that are used to study the expression, regulation and function of biomolecules,
- To develop knowledge on the basics of omics and their versatile applications,
- Integration of omics approaches for improvement of life.

Teaching methods

The teaching includes lectures, discussions, demonstrations, self-study, seminars and a project work.

Other directives

The course language is English. Course evaluation will be carried out according to the guidelines established by the Board of studies, Central University of Himachal Pradesh. Continuous evaluation will be carried out during the course.

COURSE OUTCOMES

- Inferring the basic concepts of genomics, transcriptomics and proteomics.
- Listing and discussing the use of “omics” for society
- Suggesting and outlining solution to theoretical and experimental problems in various “omics” field such as Genomics, Transcriptomics and Proteomics fields.

COURSE OBJECTIVES

1. To develop knowledge on the basics of omics and their versatile applications.
2. Integration of omics approaches for improvement of life.
3. Knowledge development on versatile techniques in “omics”

In-depth literature

Lesk, Arthur M. *Introduction to bioinformatics*. 4ed. : Oxford : Oxford University Press, 2013 - 363 s.
ISBN:9780199651566

Barh D, Azevedo V, *Omics Technologies and Bio-engineering: Towards Improving Quality of Life*, Academic Press

Wittmann, C, Lee SY, *Systems metabolic engineering*, Springer Science & Business Media Pevsner J, *Bioinformatics and Functional Genomics*, Wiley-Blackwell, ISBN: 978-81-265-3834-8

Kihara, D, *Protein function prediction for omics era*, Springer Science & Business Media

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UNIT - I

Genome & Genomics: DNA Polymorphism, Types of DNA Polymorphism, Single Nucleotide Polymorphism (SNPs), Applications of SNP technology. **Structural Genomics:** Genome Organization; **Genome Sequencing technologies** Metagenomics; Application of Bioinformatics in metagenomics.

UNIT - II

Transcriptomics: RNA-Seq, Microarrays, Regulatory RNAs: small or large

Proteomics: Basic concepts , Tools of proteomics- SDS PAGE, 2D PAGE, Liquid chromatography , Mass Spectrometry (ESI and MALDI), Protein identification by peptide mass fingerprinting , Applications of proteomics.

Metabolomics: Fundamental concept, Tools of metabolomics- Capillary electrophoresis, Gas chromatography, Electrochemical detectors, case studies.

UNIT - III

Lipidomics: Basic concepts and tools case studies

Degradomics: Techniques and concepts

UNIT - IV

Computational resources for biotechnology: Primer designing, Vector screening, Probe designing, siRNA designing, e-PCR, site directed mutagenesis, virtual -SAGE, handling and distribution of biological data-NCBI

UNIT - V

Agricultural Bioinformatics : Identification of biotic-abiotic stress related gene, screening of genomic response against pesticides and herbicides test.

UNIT -VI

Pharmacogenomics: Impact of pharmacogenomics, Pharmacokinetics, pharmacodynamics on drug discovery and evolution process ; Bioactive chemical database; Drug Bank; PubChem; KEGG DRUG

REFERENCES

1. Introduction to Proteomics -Tools for the New Biology by Daniel C. Liebler, Humana Press.
2. Mass Spectrometry for Biotechnology by Gary Siuzdak, Academic Press.
3. Proteomics for Biological Discovery by Timothy Veenstra and John Yates, Wiley.
4. Metabolomics- Methods and Protocols by Wolfram Weckwerth, Humana Press.
5. Lipidomics- Technologies and Applications by Kim Ekroos, Wiley-VCH.
6. Web/Journal Resources.
7. Transcriptomics: Expression Pattern Analysis, Virendra Gomase, Somnath Tagore; VDM Publishing, 2009 – Science
8. Introduction to Genomics by Arthur M. Leask, Oxford University Press
9. Genes series, by Benjamin Lewin, Oxford University Press
10. Computational Biology: Issues and Applications in Oncology By Ying Chen, Danh V. Nguyen (auth.), Tuan Pham (eds.)
11. Bioinformatics for Diagnosis Prognosis and Treatment of Complex Diseases By Shen, Bairong (Ed.)

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Course Name: Pedagogy of teaching learning Process
Course Code: PLS -PTL
Credits = 02

Course objectives:

To enable the student teachers to

- Understand the various theories of learning.
- Explain the nature and characteristics of teaching.
- Differentiate between teaching and learning

UNIT-1

Process of education and learning, Pedagogy, Andragogy, Critical Pedagogy- Meaning, Need and its implications in Teacher Education, Assessment in Pedagogy of Education-Competency Based Education, ICT in Teaching learning and assessment.

UNIT-2

Learning – concept, nature, characteristics, types, and factors affecting it; Learning Proces: Behaviourist, cognitive, information processing, humanist, biologicals.

UNIT-3

Development of learner and learning process, relationship between development and learning. Dimensions of individual development: Physical, cognitive, language, affective, socio-cultural and moral their interrelationship implications for teachers.

UNIT-4

Concept, nature characteristics of teaching.
Functions of teaching, Principles of teaching, phases of teaching, classroom instruction strategies, Teacher as a learner, Teaching for culturally diverse students.

UNIT-5

Teaching models & factors effecting teaching and learning process. Organizing Teaching: Memory Level (Herbartian Model), Understanding Level (Morrison teaching Model), Reflective Level (Bigge and Hunt teaching Model).

Reference Books:

1. Bhatt, H. The diary of a school teacher: An Azim Premji University publications, www.arvindguptatoys.com/arvindgupta/diary-school-teacher-eng.pdf
2. Carr, D (2005), Making Sense of Education: An Introduction to the Philosophy and Theory of Education and Teaching, Routledge.
3. Delpit, L (2006). Other People's children, Cultural Conflict in the Classroom. The New press.
4. Lampert, M. (2001). Teaching Problems and the Problems of Teaching. Yale University press.
5. Textbook for B.Ed. Pedagogy of Science: Physical Science Part I & Part II. National Council of Educational Research and Training, 2013.

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Course Name: Indian Traditional Knowledge and practices

Course Code: PLS-ITK

Credits = 02

Course objectives:

- To facilitate the students with the concepts of Indian traditional knowledge and to make them understand the importance of roots of knowledge system.
- To make the students understand the perspective of how different cultures utilize medicinal plants.
- Explain the need and importance of protecting traditional knowledge.

UNIT-1

The Pre-Vedic Period (Primitive period) (10000 B.C. – 1500 B.C.). The Vedic Period (1500 B.C. – 500 B.C.): Description of Medicinal plants and Functional foods in Vedas viz. Rigveda, Yajurveda, Atharveda.

UNIT-2

The Post-Vedic Period (500 B.C. – A.D. 600): Description of use of Medicinal plants, Functional foods, and Pharmaceutical dosage forms in ancient Ayurvedic treatises like Charaka Samhita, Sushruta Samhita etc.

UNIT-3

The Early Mediaeval Period (A.D. 600 - A.D. 1400): Description of use of Medicinal plants, Functional foods in various ancient Ayurvedic treatises like Ashtanga Samgraha, AshtangaHridya, Chakradatta, Sharangdhara Samhita, Bhel Samhita, Harita Samhita, Vangasena, GadaNigraha etc.

UNIT-4

The Late Mediaeval Period (A.D. 1400 – A.D. 1800): Description of use of Medicinal plants, Functional foods in various ancient Ayurvedic treatises like Bhava Prakasha, BhaishajyaRatnavali, Yoga Ratnakara, ArkaPrakasha etc.

UNIT-5

Modern Period (since 19th century to continue): Recent developments in medicinal plants and pharmaceutical science

Reference Books:

1. Traditional Knowledge System and Technology in India (English, Hardcover, Basanta Kumar - Mohanta, Vipin Kumar Singh) Edition : 2012 Language English
2. Panpaatu Maanudaviyal: Author: Bakthavachala Barathi, Meyappan Pathippagam,Chidambaram- Edition2009; Language: Tamil
3. Traditional Knowledge System in India, by Amit Jha, 2009.
4. Traditional Knowledge System in India by Amit Jha Atlantic publishers, 2002
5. Knowledge Traditions and Practices of India " Kapil Kapoor1, Michel Danino.
6. V. Sivaramakrishnan (Ed.), Cultural Heritage of India-course material, Bharatiya Vidya Bhavan, Mumbai. 5th Edition, 2014

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