GENERAL INSTRUCTIONS AND COURSE CURRICULUM

for

Add on Courses

FOR

Diploma Course

in

Biotechnology

Effective from Academic Session

2024-2025

Department Of Biotechnology

HIMACHAL PRADESH UNIVERSITY

Summer Hill, Shimla-171005

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SUMMER HILL, SHIMLA-171005

Diploma Course in Biotechnology

GENERAL INSTRUCTIONS/ GUIDELINES FOR EXECUTION OF CURRICULUM

I. The Diploma course in Biotechnology will be of one year duration split into two semesters.

1. **Add on Courses [AOC]:** A total of four AOC will be offered by the department. AOC of 2-credits includes the theory and practical component of 25 marks each.

   NOTE: The practical [PR] examination will carry 25 marks as follows;

Performance and write-up of practicals:	15.0 marks
Practical record/ Notebook:	5.0 marks
Viva voce examination:	5.0 marks

II. A candidate has to secure minimum pass marks individually in Theory [TH] paper and Practical [PR] examination to earn full credits in the concerned course. A candidate thus failing in any of these components shall be considered failed in that course.

- **A student will be awarded Diploma in Biotechnology after securing 8 credits**

III. Eligibility: UG Medical or its equivalent with 45 % or above marks from any recognized University.

Outline of Diploma Course in Biotechnology

Course Code	Title of the Course	Marks		Total Marks	Credits
		Theory	Practical		
Semester I					
BT-AOC-1	Basics of Analytical Techniques	25	25	50	2
BT-AOC-2	Bioinformatics and Artificial Intelligence	25	25	50	2
Total Marks/credits in Semester I		**50**	**50**	**100**	**4**
Semester II					
BT-AOC-3	Traditional Fermented Foods and Beverages of Himachal Pradesh	25	25	50	2
BT-AOC-4	Indigenous Medicinal and Aromatic Plants	25	25	50	2
Total Marks/credits in Semester II		**50**	**50**	**100**	**4**
Grand Total (Semester I+II)		**100**	**100**	**200**	**8**

COURSE: BT-AOC-1
BASICS OF ANALYTICAL TECHNIQUES

L	T	P	C
1	0	1	2

Theory: 15 Credit Hours *Theory examination: 25 marks*
Practical: 30 Credit Hours *Practical examination: 25 marks*
Total Marks: 50

NOTE: Instructions for setting question paper
The examiner will set a total of nine (9) questions covering the entire syllabus. Out of nine questions, Q. No. 1 containing five short -answer type questions that will cover entire syllabus will be compulsory. There will be 4 questions from each section. Students will attempt five questions in total by selecting two questions from each section and the compulsory question. All questions shall carry equal marks (5 marks each).

SECTION-I **(8 hours)**

Basics of microscopy: Principle of microscopy, resolution and magnification
Sterilization: Autoclave, laminar air flow, HEPA filters, dry and wet sterilization and their applications
Centrifugation: Basics, principle, types and applications
Chromatography: Basics, principle and applications, TLC, HPLC and GC-MS

(7 hours)

SECTION-II

Electrophoresis: Basics, principle and applications, Native PAGE and SDS PAGE,
Spectrophotometry: UV & Visible spectroscopy, Florescent activated cell sorter (FACS).
Molecular analysis: DNA isolation (prokaryotic and eukaryotic), DNA amplification, Primer designing, Gene cloning, CRISPER Cas-9 Technology and applications

Course objectives:
1. Students will understand the basic techniques and instruments used.
2. Students will understand the principles on which various techniques work.

Course learning outcomes:
1. All the basic and advanced technique skill enhancement
2. Develop a deeper understanding of instruments.

Suggested books[Latest Edition]:

1. Principles and Techniques of Practical Biochemistry by K. Wilson & J. Walker.
2. Basic Biotechniques for Bioprocess and Bioentrepreneurship byA. K. Bhatt, R. K. Bhatia & T. C.Bhalla.
3. Spectroscopy of Biological Molecules: Modern Trends by P. Carmona, R. Navarro, A. Hernanz.
4. Molecular Fluorescence: Principles and Application by B.Valeur.

List of practicals:
1. Verification of Beer – Lambert Law by Biuret Method.
2. To perform salting out for partial purification of protein(s) in a given mixture.
3. To perform chromatography (paper, TLC and gel chromatography)
4. To perform Agarose Gel electrophoresis of DNA.
5. SDS-PAGE of proteins.
6. Polymerase Chain reaction.
7. Sandwich ELISA.
8. Qualitative and quantitative analysis of DNA by UV Spectrophotometry.

COURSE: BT-AOC-2
BIOINFORMATICS AND ARTIFICIAL INTELLIGENCE

L	T	P	C
1	0	1	2

Theory: 15 Credit Hours *Theory examination: 25 marks*
Practical: 30 Credit Hours *Practical examination: 25 marks*
Total Marks: 50

NOTE: Instructions for setting question paper
The examiner will set a total of nine (9) questions covering the entire syllabus. Out of nine questions, Q. No. 1 containing five short -answer type questions that will cover entire syllabus will be compulsory. There will be 4 questions from each section. Students will attempt five questions in total by selecting two questions from each section and the compulsory question. All questions shall carry equal marks (5 marks each).

SECTION-I (8 hours)

Sequence information sources: EMBL, GENBANK, Entrez, and Unigene. Protein information sources: PDB, SwissProt and TrEMBL; Sequence and phylogeny analysis: Introduction to BLAST, multiple sequence alignment, phylogenetic analysis.

Molecular modeling: introduction, dynamic simulation, conformational search, molecular modeling packages (Chem3D, Hyperchem), protein modeling, structure prediction and molecular docking. Role in drug designing and synthetic biology.

SECTION-II (7 hours)

Protein engineering, Methods of Mutagenesis and Library creation: Random Mutagenesis, Targeted Mutagenesis and Gene Shuffling. Directed Laboratory Evolution and Rational Protein Designing: Concepts, strategies and applications.

AI in Biotechnology: Applications of AI in the Pharmaceutical Industry, drug design, clinical trials, precision medicine, medical imaging, monitoring health and disease, synthetic biology, transforming Agriculture with AI

Course objectives:
1. To make students understand the basics of bioinformatics.
2. Learn how Artificial Intelligence is being used in various Biotech & health tech sector
3. Experience LIVE how Artificial Intelligence is revolutionizing health care

Course learning outcomes:
1. Students will be able to understand basic bioinformatics software and programs
2. Student will be able to grasp the AI knowledge and its role in human welfare

Suggested books[Latest Edition]:

1. Bioinformatics: Methods and Applications Genomics Proteomics and Drug Discovery by S. C. Rastogi, N. Mendiratta & P. Rastogi.
2. Protein Engineering: Principles and Practice by J. L. Cleland& C. S. Craik.
3. Artificial Intelligence and Biotechnology: The Golden Age of Medical Research by U. Kumar, K. K. Gupta.
4. Artificial Intelligence in Biotechnology by P. Kartan.

List of practicals:
1. Understanding and using on web: Embl, Genbank, Entrez, Unigene
2. Understanding and using on web: PDB, Swissprot, TrEMBL, BLAST, Clustal-W.
3. Study of drug and protein/enzyme interactions through molecular docking.
4. Creation of patient database for better management of health facilities/services.
5. Development of disease prediction models through AI enabled technologies.
6. Use of drones in agriculture field imaging.
7. Use of AI apps to find and study the plant diseases.

COURSE: BT-AOC-3

TRADITIONAL FERMENTED FOODS AND BEVERAGES OF HIMACHAL PRADESH

L	T	P	C
1	0	1	2

Theory: 15 Credit Hours *Theory examination: 25 marks*

Practical: 30 Credit Hours *Practical examination: 25 marks*

Total Marks: 50

Note: Instructions for setting question paper

The examiner will set a total of nine (9) questions covering the entire syllabus. Out of nine questions, Q. No. 1 containing five short -answer type questions that will cover entire syllabus will be compulsory. There will be 4 questions from each section. Students will attempt five questions in total by selecting two questions from each section and the compulsory question. All questions shall carry equal marks (5 marks each).

SECTION-I (8 hours)

Traditional fermented foods of Himachal Pradesh: Traditional methods of fermented food preparation, cereal based, milk based, legume based, vegetable/fruit based fermented foods of Himachal Pradesh (basic ingredients, composition and nutritive value), Specific fermented foods as religious and cultural symbols, microbiology of fermented foods, starters used in traditional food fermentations.

Probiotics and prebiotics :concepts of probiotics and prebiotics, traditional fermented products as the source of probiotics and prebiotics, probiotic functional foods.

SECTION-II (7 hours)

Traditional fermented beverages of Himachal Pradesh: Traditional alcoholic beverages (diversity, composition, production process, ethnic starters used, nutritive value and microbiology) of fermented beverages such as *chhang, angoori, chulli, arak, sura,* traditional nonalcoholic beverages, role of yeasts in fermented beverage production, traditional nonalcoholic beverages.

Biotechnology and traditional food fermentation: Applications of Biotechnology in fermented food and beverage production, industrial development of processes, molecular characterization of microbial diversity in fermented products, role of metagenomics and metabolomics in traditional food fermentations, sustainable development of traditional fermented products.

Course objectives:

1. To acquire basic information on traditional fermented foods and beverages of Himachal Pradesh.
2. To create understanding on traditional methods and microorganisms involved in preparation of these fermented food and beverage.

Course learning outcomes:

1. Students will be able to describe the significance of fermented foods and beverages in tradition and culture of Himachal Pradesh
2. Students will be able to understand the importance of traditional fermentation and different microorganisms involved in traditional food fermentation.

Suggested books[Latest Edition]:

1. Indigenous fermented foods of South Asia by V.K. Joshi.
2. Handbook of Enology by V.K. Joshi.
3. Biotechnology, Food Fermentation: Microbiology, Biochemistry and Technology by V.K. Joshi & A. Pandey.

List of practicals:

1. Documentation of indigenous fermented products of Himachal Pradesh.
2. Preparation of fermented foods and beverages under laboratory conditions.
3. Isolation of microorganisms from fermented products of Himachal Pradesh.
4. Biochemical analysis of fermented foods and beverages.
5. Nutritional analysis of fermented foods and beverages.

COURSE: BT-AOC-4
INDIGENOUS MEDICINAL AND AROMATIC PLANTS

L	T	P	C
1	0	1	2

Theory: 15 Credit Hours *Theory examination: 25 marks*
Practical: 30 Credit Hours *Practical examination: 25 marks*
Total Marks: 50

NOTE: Instructions for setting question paper
The examiner will set a total of nine (9) questions covering the entire syllabus. Out of nine questions, Q. No. 1 containing five short -answer type questions that will cover entire syllabus will be compulsory. There will be 4 questions from each section. Students will attempt five questions in total by selecting two questions from each section and the compulsory question. All questions shall carry equal marks (5 marks each).

SECTION-I (8 hours)

IMPs: Brief history of use of medicinal plants; Introduction to indigenous systems of medicines-Ayurveda, Unani and Siddha system of medicine. IMPs as industrial crops - constraints and remedial measures. Medicinal plant diversity & Tribal healthcare. Plants Used for the medicinal applications and decoctions.

Aromatic plants: Introduction and historical background of aromatic plants. Important Aromatic plants of Himalayan Region. Demand and supply of medicinal plants. Demand and supply of aromatic cosmetic products, development and commercialization of products.

SECTION-II (7 hours)

National Medicinal Plant Boardand State Medicinal Plant Boards - objectives and functions. In situ and ex-situ conservation and cultivation of medicinal and aromatic plants,issues and approaches. Scientific validation of local herbals practices**.**

Biotechnology of medicinal plants: Identification of local medicinal and aromatic plants, extraction and purification of phytochemicals, antimicrobial and MIC analysis, qualitative and quantitative analysis i.e. HPLC, GC-MS, FTIR, NMR, XRD etc.

Course objectives:
1. To acquire basic information on medicinal and aromatic plants of Himachal Pradesh.
2. To create understanding on the use of Himalayan medicinal and aromatic plants of Himachal Pradesh.

Course learning outcomes:
1. Students will be able to describe the significance medicinal and aromatic plants of Himachal Pradesh
2. Students will be able to understand the importance of medicinal and aromatic plants and their commercial applications.

Suggested books [Latest Edition]:
1. Basic Biotechniques for Bioprocess and Bioentrepreneurship by A. K. Bhatt, R. K. Bhatia &T. C. Bhalla.
2. Indian Medicinal Plants by P.C. Trivedi.
3. Medicinal Plants of Indian Himalaya by S.S. Samant & U. Dhar.
4. Hand Book of Aromatic Plants by S.K. Bhattacharjee.
5. Handbook of MAPs by S.K. Bhattacharjee.

List of practicals:
1. Documentation of indigenous herbal knowledge of Himachal Pradesh.
2. Collection of local medicinal plants from tribal regions of Himachal Pradesh.
3. Extraction of important phytochemicals by solvent extraction methods.
4. TLC analysis of phytoconstituents.
5. Antimicrobial and MIC analysis of active phytoconstituents
6. Purification of important phytochemicals by HPLC.