

<b>COURSE TITLE</b>	<b>INFORMATION RETRIEVAL IN PROTEOMICS AND METABOLOMICS</b>
<b>COURSE CODE</b>	<b>01CB0705</b>
<b>COURSE CREDITS</b>	<b>3</b>

**Objective:**

- 1 The course aims to equip students with proteomics, metabolomics, and their applications in biological and biomedical research.

**Course Outcomes:** After completion of this course, student will be able to:

- 1 Apply proteomics and metabolomics in biology and medicine using real-world examples.
- 2 Apply tools to find omics data from online databases and software.
- 3 Analyze omics data to find key proteins, metabolites, and patterns.
- 4 Evaluate ways to combine and compare data from different bioinformatics databases.

**Pre-requisite of course:**None

**Teaching and Examination Scheme**

<b>Theory Hours</b>	<b>Tutorial Hours</b>	<b>Practical Hours</b>	<b>ESE</b>	<b>IA</b>	<b>CSE</b>	<b>Viva</b>	<b>Term Work</b>
2	0	2	50	30	20	25	25

<b>Contents : Unit</b>	<b>Topics</b>	<b>Contact Hours</b>
1	<b>Advances in Proteomics and its applications</b> Overview of proteomics and its significance in biological research, Types of proteomics and associated challenges, Clinical and Biomedical Applications: Biomarker discovery for disease diagnosis, Proteomics in drug discovery, Agricultural Proteomics: Proteomics in plant and microbial research	8
2	<b>Advances in Metabolomics and its applications</b> Overview of metabolomics and its significance in systems biology, Role of computational methods in metabolomics data retrieval, Key challenges in metabolomics research, Metabolomics Databases and Resources, Data formats in metabolomics, Computational tools for metabolite data retrieval	7
3	<b>Data Retrieval and submission</b> Data retrieval methods: Sequence-based, Text-based, and ID based searches, Sequence data retrieval, Tools for sequence retrieval, Database submission process & Tools, Data preparation guidelines, Submission formats	8

<b>Contents : Unit</b>	<b>Topics</b>	<b>Contact Hours</b>
4	<b>Data integration and Cross-referencing</b> Overview of data integration and cross-referencing, Database identifiers and accessions, Linking between databases	5
<b>Total Hours</b>		<b>28</b>

#### Suggested List of Experiments:

<b>Contents : Unit</b>	<b>Topics</b>	<b>Contact Hours</b>
1	<b>Experiment 1</b> Batch-retrieve a small proteomics dataset from PRIDE or UniProt using a query.	2
2	<b>Experiment 2</b> Predict protein function using BLAST and Pfam for a single unknown protein sequence.	2
3	<b>Experiment 3</b> Analyze one proteomics dataset from PRIDE to identify proteins linked to a specific disease.	4
4	<b>Experiment 4</b> Calculate basic physicochemical properties of a protein using ExPASy ProtParam.	2
5	<b>Experiment 5</b> Retrieve and identify the proteome of a model plant species (e.g., Arabidopsis) from Plant Ensembl.	2
6	<b>Experiment 6</b> Retrieve and identify the proteome of a model animal (e.g., Human or Mouse) from Ensembl.	2
7	<b>Experiment 7</b> Use DBGET to retrieve a known metabolic pathway for a model organism.	2
8	<b>Experiment 8</b> Retrieve a protein sequence using Entrez with specific gene/protein name filters.	2
9	<b>Experiment 9</b> Use basic Linux commands to locate and display biological data files (FASTA/GTF) in a folder.	2
10	<b>Experiment 10</b> Prepare a mock submission file for nucleotide sequence data using Sequin or Webin-Tool format.	2
11	<b>Experiment 11</b> Prepare a sample metadata sheet for SRA submission with sample and experiment info.	4
12	<b>Experiment 12</b> Explore MetaboLights and retrieve compound metadata for one study.	2
<b>Total Hours</b>		<b>28</b>

**Textbook :**

- 1 Information Retrieval in Bioinformatics: A Practical Approach, S. Dutta and Saikat Gochhait (Eds.), Springer Nature, 2022

**References:**

- 1 Biomedical Informatics: Computer Applications in Health Care and Biomedicine, Biomedical Informatics: Computer Applications in Health Care and Biomedicine, Edward H. Shortliffe, James J. Cimino (Eds.) , Springer, 2021
- 2 Genomics, Proteomics, and Metabolomics: Stem Cells Monitoring in Regenerative Medicine, Genomics, Proteomics, and Metabolomics: Stem Cells Monitoring in Regenerative Medicine, Babak Arjmand (Ed.) , Springer, 2019
- 3 Handbook of Proteomic Methods, Handbook of Proteomic Methods, P. Michael Conn (Ed.) , Springer, 2003

**Suggested Theory Distribution:**

The suggested theory distribution as per Bloom’s taxonomy is as follows. This distribution serves as guidelines for teachers and students to achieve effective teaching-learning process

Distribution of Theory for course delivery and evaluation					
Remember / Knowledge	Understand	Apply	Analyze	Evaluate	Higher order Thinking / Creative
0.00	0.00	35.00	35.00	30.00	0.00

**Instructional Method:**

- 1 The course delivery method will depend upon the requirement of content and need of students. The teacher in addition to conventional teaching method by black board, may also use any of tools such as demonstration, role play, Quiz, brainstorming, MOOCs etc.
- 2 The internal evaluation will be done on the basis of continuous evaluation of students in the laboratory and class-room.
- 3 Practical examination will be conducted at the end of semester for evaluation of performance of students in laboratory.

**Supplementary Resources:**

- 1 <https://www.youtube.com/watch?v=YjSmioKI134>
- 2 <https://www.youtube.com/watch?v=ug1cbJHzT8o>
- 3 <https://www.youtube.com/watch?v=CIuqbjm41Eg>
- 4 <https://www.youtube.com/watch?v=oB9asj8YzFE&t=558s>