



**SAFI INSTITUTE OF ADVANCED STUDY, (SIAS)**

**DEPARTMENT OF MICROBIOLOGY**

**ADD ON COURSE SYLLABUS FOR UG COURSES**

## SEMESTER I

### ADDBMB01. HUMAN MICROBIOME

#### **Objective**

The goal of the course is to characterize the human microbiome and analyze its role in human health and diseases. We are dependent on these bacteria to help digest our food, produce certain vitamins, regulate our immune system, and keep us healthy by protecting us against disease-causing bacteria.

**Module I.** Morphology and Physiology of Bacteria, Normal Micro flora of Human body, General identification procedures for various pathogenic bacteria & fungi.

**Module II.** Human micro biome- definition, source, current understanding, significance, Human microbiome in health and diseases. Healthy human microbiome- understanding of the healthy microbiome, Population-scale baseline cohorts

**Module III.** Typical components and diversity of the microbiome: bacterial components of a healthy microbiome, Achaea, viruses, fungi, and other eukaryotes, Geographical variation in the healthy micro biome. Microbiome establishment and early colonization. Gut micro biota. Microbiome database.

**Module IV.** Human microbiome project, HMP based on Pregnancy & Preterm Birth, Onset of Inflammatory Bowel Disease (IBD), Onset of Type 2 Diabetes, Metagenome, Hologenome, Holobiont, Co-evolution, Cospeciation, Codiversification, Phyllosymbiosis, Vertical transmission, Horizontal transmission. Human microbiome in evolution:

#### **Suggested reading**

1. Ananthanarayan and Panicker, Text book of Microbiology, 10<sup>th</sup> Edition
2. Human Microbiome Project Consortium (June 2012). "Structure, function and diversity of the healthy human microbiome". Nature. 486 (7402): 207–14 .
3. The Integrative Human Microbiome Project **569**, 2019. 641–648
4. Jason Lloyd-price, Galeb Abu-ali, Curtis Hutton-Hower., 2016. Healthy human microbiome, Genome medicine 8(1).

## **SEMESTER III**

### **ADDBMB02. ENVIRONMENT LAW AND SUSTAINABLE DEVELOPMENT**

**Duration: 30 hrs**

#### **Objective**

Aims at imparting the knowledge on various Environmental laws

#### **Learning outcome**

By the end of the course, students will have the knowledge of various laws and policies that is following in the country. They will have the basic idea about the different parameters of Environment.

#### **Prerequisites**

This is an introductory course at the degree level. Basic knowledge on Environment systems, various pollution aspects, factors responsible for pollution, Pollution control measures, Idea about general recalcitrant xenobiotics etc. is required.

**Module 1:** Environmental law- Definition, History in Indian Scenario, General Principles of Environmental Law, International Parameters of Environment

**Module II:** Environmental Laws in India, Indian Judiciary and Environmental Protection, India and International Environmental Law

**Module III:** Constitutional Provision for The Environmental Protection, Various Environmental Protection Acts (The National Green Tribunal Act, 2010, The Air (Prevention and Control of Pollution) Act, 1981, The Water (Prevention and Control of Pollution) Act, 1974, The Environment Protection Act, 1986, The Hazardous Waste Management Regulations, The National Green Tribunal Act, 2010, The Air (Prevention and Control of Pollution) Act, 1981, The Water (Prevention and Control of Pollution) Act, 1974, The Environment Protection Act, 1986, etc.) Hazardous Wastes Management Regulations, Other Laws Relating to Environment

**Module IV:** Sustainable development, Stockholm Declaration, 1972 to R10 Summit, Contemporary Developments

#### **Method of Evaluation/Grading**

The goal of the course is to familiarize with the different laws and policies that are prevailing in the country. The evaluation will be done by conducting objective type test papers and viva.

### **Suggested reading**

1. "Legislations on Environment, Forests, and Wildlife" from the Official website of: Government of India, Ministry of Environment & Forests
2. "India's Forest Conservation Legislation: Acts, Rules, Guidelines", from the Official website of: Government of India, Ministry of Environment & Forests
3. Wildlife Legislations, including - "The Indian Wildlife (Protection) Act" from the Official website of: Government of India, Ministry of Environment & Forests
4. Official website of: Government of India, Ministry of Environment & Forests
5. <http://www.wealthywaste.com/wildlife-protection-act-1972-a-summary>
6. <http://envfor.nic.in/legis/wildlife/wildlife1.html>
7. <http://statutory-law.knoji.com/the-salient-features-of-the-indian-wild-life-protection-act-1972/>
8. <http://siteresources.worldbank.org/INDIAEXTN/Resources/295583-1176163782791/complete.pdf>
9. <http://www.asiantribune.com/index.php?q=node/6083>
10. <http://www.legalserviceindia.com/articles/brenv.htm>
11. [http://moef.nic.in/downloads/publicinformation/critically\\_endangered\\_booklet.pdf](http://moef.nic.in/downloads/publicinformation/critically_endangered_booklet.pdf)
12. <http://www.thaindian.com/newsportal/india-news/madhya-pradesh.html>
13. [http://www.ngosindia.com/resources/pil\\_sc.php](http://www.ngosindia.com/resources/pil_sc.php)
14. <http://www.downtoearth.org.in/content/green-tribunal-suspends-environmental-clearancegogte-minerals>
15. [http://articles.economictimes.indiatimes.com/2011-11-16/news/30405840\\_1\\_lavasa-corporationlavasa-township-moef](http://articles.economictimes.indiatimes.com/2011-11-16/news/30405840_1_lavasa-corporationlavasa-township-moef)
16. [http://www.tehelka.com/story\\_main52.asp?filename=Ne140412POSCO.asp](http://www.tehelka.com/story_main52.asp?filename=Ne140412POSCO.asp)
17. <http://www.constitution.org/cons/india/const.html>

## **ADDBMB03. ALGORITHMS IN COMPUTATIONAL BIOLOGY**

Duration: 30 hr

### **Objective:**

Aims at imparting practical knowledge on Computational Biology and its applications to the students studying any discipline of Science.

### **Learning Outcome:**

By the end of the course students will have a working knowledge of a variety of publicly available data and computational tools, and a grasp of the underlying principles that is adequate for them to evaluate, use and develop novel techniques as needed. They are also exposed to various statistical methods to analyze their experimental data.

**Prerequisites:**

This is an introductory course at the degree level. Basic knowledge on Biology, Computers and Internet required.

**Module I:** Introduction to Biological Databases-Sequence database-Nucleotide sequence database-NCBI-Genbank,Protein sequence database-Swissprot,Structure database-PDB-Retrieval of sequence and structure from Databases

**Module II:** Sequence analysis-Algorithms and Programs-Aligning two sequences-Dynamic Programming- Global (Needleman and Wunsch) - Local (Smith and Waterman)-Importance of sequence alignment-Analysis using EMBOSS package.

**Module III:** Heuristic Algorithms for Database searching- BLAST-Phylogenetic Analysis-UPGMA and Neighbor joining.

**Module IV:** Protein Structure Visualization –Rasmol-Protein Structure stereochemical quality prediction-Protein Physico chemical property prediction-ExPasy.

**Method of Evaluation/Grading:**

The goal of this course is to familiarize with the use of Computational techniques in addressing real scientific problems. There will be several problem sets and these problem sets are intended to give you hands on experience with the work of Computational Biology, and should be the learning experiences as well as evaluation tools. At the end of the course there shall be one examination of 3 hours duration based on the course and practical contents. The evaluation scheme for each course shall contain two parts; (a) internal evaluation and (b) external evaluation. 25% weightage shall be given to internal evaluation and the remaining 75% to external evaluation.

**Suggested Readings:**

1. Attwood TK & Parry-Smith DJ. 2003. *Introduction to Bioinformatics*. Pearson Education.
2. Rastogi SC, Mendiratta N & Rastogi P. 2004. *Bioinformatics: Concepts, Skills and Applications*. CBS.
3. Molecular modeling by Andrew Leach.
4. Bioinformatics, Sequence and Genome Analysis by David W. Mount.

## SEMESTER V

### ADDBMB04. FOOD HEALTH AND HYGIENE

Duration: 30 hrs

#### Objectives

To understand the basics of food nutrition, health and food hygiene.

#### Learning outcomes

Learners will understand the concept of food health, food hazards and the legal requirements in food safety.

**Module I. Introduction to food:** Carbohydrates, proteins, fat, fibres, vitamins and minerals- functions, requirements, food sources and deficiencies. Effect of food processing on food nutrition. Basics of food safety. Food contaminants (microbial, chemical, physical). Food additives (classification, functional role, safety issues). GM foods.

**Module II. Food microbiology:** Food spoilage- types, role of microbes, factors influencing spoilage and prevention of food spoilage. Food borne hazards of microbial origin- types, bacterial infections and intoxications.

**Module III. Food safety and quality:** Good manufacturing practices in food industry. Food control agencies and their regulations. Food safety management systems- HACCP, FSO, ISO 22000. Codes for GMP.

**Module IV. Food laws and regulations:** Essential commodities act, standards of weights and measures act, AGMARK, Bureau of Indian Standards, Export and quality control, prevention of food adulteration act.

#### Method of Evaluation/Grading

The evaluation will be done by conducting objective type test papers and viva.

#### Suggested reading

1. Basic food microbiology – Banwart GJ
2. Biochemistry – DM Vasudevan and S Sreekumari
3. Food microbiology – Adams MR and Moss MO
4. Food Microbiology – Frazier WC and Westhoff
5. Food Microbiology (2nd Ed )– Doyle et al.
6. Food Microbiology – Vijaya Ramesh
7. Food science and safety standards- P Halde, S K Sharma



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## SEMESTER I

### ADDMBM 01. RESEARCH METHODOLOGY

Duration: 30 hrs

#### Course Description

This course introduces research methods as they apply to the higher studies. This will enhance students to inculcate basic scientific temperament and research ethics.

#### Learning Outcome

After completion of this course, students will be able to

- Demonstrate knowledge of research processes (reading, evaluating, and developing);
- Perform literature reviews using print and online databases;
- To make use of software formats for citations and referencing
- Identify, explain, compare, and prepare the key elements of a research proposal/report.
- Statistical Analysis and Interpretation of Data

**Module I:** Definition, Science and research, Ethics, Meaning of Research, Objectives of Research, Motivation in Research, Types of Research, Research Approaches, Significance of Research-Epistemology

**Module II:** Goals of research, Essential qualities of a researcher, Scientific temperament and attitude. Methods of research, Scientific method versus arbitrary methods. Logical scientific methods- Deductive method, Inductive method-deductive inductive method, Different types of Inductive logical method.

**Module III:** Types of research: Descriptive, Analytical, Fundamental, Applied, Quantitative, Qualitative, Conceptual, Empirical-Surveys, Ex post facto research Data and Methods for sample collection. Observations, Field investigations, Direct studies. Types of data-Categorical, Nominal, or ordinal, continuous or mixed, primary data, secondary data, limitations and precautions in data collection

**Module IV:** Steps in doing research, Reading and understanding a research article, Review of literature, NISCAIR, Library resources, Journals, periodicals, reviews, abstracts, treatise, monographs, searching of web resources. Identification of research gaps, Selection of a research topic, developing a research plan, Significance of hypothesis, Execution of research work, Meaning and nature of experimental research, Variations and variables. Statistical applications in research. General laboratory Safety



**Module V:** Scientific writing and presentation of scientific data. Styles of writing, use of computers, Structure of a research proposal/paper. Styles of referencing, Presentation tools and skills

**Method of Evaluation/Grading**

Practical- Use of web resources

Hands own training in Mendley reference manager, Graph Pad PRISM, SPSS

Seminar -1 Critically evaluate and summarize a published thesis

Assignment -1 Preparation of a project proposal

Written exam

**Suggested reading**

1. Kothari, C.R. (2004). Research Methodology: Methods and Techniques, New Age International Publishers, New Delhi
2. Paneerselvam R (2004) Research Methodology, Prentice Hall of India, New Delhi
3. Arya., P.P. and Pal, Y. (2001), Research Methodology in Management: Theory and Case Studies, Deep and Deep Publishers Pvt. Ltd., New Delhi
4. Robert A. Day (1998), How To Write & Publish a Scientific Paper. Oryx Press; 5 editions
5. Frank D. Bell (1995), Basic Biostatistics: Concepts for the Health Sciences. William C. Brown
6. Suresh C. Sinha and Anil K. Dhiman, (2002), Research Methodology (2 Vols-Set) Vedams Books (P) Ltd.
7. Day RA (1992) How to write and publish a scientific paper, Cambridge University press, London

**SEMESTER IV**

**ADDMBM 02. CHEMINFORMATICS AND DRUG DISCOVERY**

Duration: 30 hr

**Objective:**

This course aims at application of modern in silico tools or information technology in different phases of drug discovery and design of new drug candidates by understanding the molecular basis of the interaction of small molecules with their targets.

**Learning Outcome:**

After finishing this course, the students are expected to be familiar with modern cheminformatics and bioinformatics approaches, including QSAR, pharmacophore modeling, molecular docking, virtual screening, ADME/Toxicity predictions, sequence alignment, homology modeling, and protein structure prediction.

**Prerequisites:**

This course gives introductory knowledge of computer-aided drug design, including both cheminformatics and bioinformatics. Prerequisites of the course include basic knowledge of Chemistry, Biology, Pharmacology and Bioinformatics.

**Course Content:**

**Module I:** Introduction to Molecular Modeling-Homology Modeling, Drug Discovery: The evolution and Process, Brief history of Drug Discovery, Leads, Hits and Drugs, Lead optimization.

**Module II:** The Role of Computer Assisted Drug Design, Drug action, ADMET, Pharmacokinetics, The process of Drug Discovery, Methodology.

**Module III:** Lipinski's Rule of Five, Databases-PUBCHEM, Drugs/ Ligands, Docking, Types of Searching Methods in Docking, Docking Methods, Docking Using AUTODOCK.

**Module IV:** Application of Chemoinformatics in Drug Discovery, Ligand Representation, Conformational Analysis, Force Fields, Types of Drug/Receptor Interaction

**Method of Evaluation/Grading:**

The goal of this course is to introduce the participants to different computational methods for drug discovery and development. At the end of the course there shall be one examination of 3 hours duration based on the course and practical contents. The evaluation scheme for each course shall contain two parts; (a) internal evaluation and (b) external evaluation. 25% weightage shall be given to internal evaluation and the remaining 75% to external evaluation.

**Suggested Readings:**

1. Advanced Computer- Assisted Techniques in Drug Discovery in Methods and Principles in Medicinal Chemistry by Han van de Waterbeemd (ed.) Volume 3, 1994, VCH Publishers, New York, NY (USA).
2. Molecular Modeling in Methods and Principles in Medicinal Chemistry by Hans-Dieter Holtje and GerdFolkers, Third edition, Volume 5, 1996, VCH Publishers, New York, NY (USA).
3. Structure-Based Ligand Designin Methods and Principles in Medicinal Chemistry by Klaus Gubernator, Hans-Joachim Bohm, Volume 6, 1997, VCH Publishers, New York, NY (USA).
4. Virtual Screening for Bioactive Molecules by in Methods and Principles in Medicinal Chemistry, Edited by Hans-Joachim Bohm and Gisbert Schneider, Volume 10, 2000.