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Amity Institute of Biotechnology -Minutes of Board of Studies

2019-2020

Minutes of the Meeting of the Board of Studies in Biotechnology May 2020 held by Circulation through email

1. The meeting of the Board of Studies in Biotechnology May 2020 was convened by Prof.(Dr.) Vinay Sharma, Director, AIB .
2. As per instructions from Prof. Sharma,in view of the current covid 19 situation of lockdown the agenda of the meeting was circulated by mail by Dr Shruti Mathur on 15-05-2020 to all the following members of the BoS:
   (i) Mr Mukesh Agarwal, MD, Ayushraj Enterprises Pvt . Ltd. Jaipur (Industry expert)
   (ii) Prof. NilimaKumari ,Dept of Biosciences and Biotechnology, Banasthali Vidyapeeth, Banasthali, Tonk. Rajasthan. (External subject expert)
   (iii)Dr. Bharat Singh , Assoc. Prof. AIB (Internal subject expert)
   (iv)Dr. Vikram Kumar Yadav ,Asst. Prof.AIB (Internal subject expert)
   (v) Dr. Manali Datta, Asst.. Prof. AIB (Special invitee)
   (vi)Dr. Sanket Kaushik, Asst. Prof. AIB (Special invitee)
   (vii) Dr. Kumar Sambhav Verma, Asst. Prof. AIB (Special invitee)
   (viii) Dr. Desh Deepak Singh, Assoc. Prof. AIB (Special invitee)
   (ix) Dr. S. S. Lakhawat, Asst. Prof. AIB (Special invitee)
3. All agenda points as listed below were approved :

   (1) Change in MSc Biotechnology (Sem I&II) evaluation criteria for Domain Electives (DE) from 30:70 to 50:50 (Internal : External) in relation to focus on continuous assessment and increase student engagement was approved.

   (2) Introduction of new courses for pre-PhD Institutional Course Work PBT105: Advances in Nanoscience and Nanotechnology and PBT106: Advances in Pharmaceutical Science and Technology was approved.

   (3) In addition, Prof. NilimaKumari suggested corrections in the syllabus as follows:

   - In domain elective courses each of the five modules should have uniform pattern of headings according to the contents of the module.

e.g. M.Sc Biotechnology: Domain Electives (DE)
Course Code: MSB130, INSTRUMENTATION IN BIOTECHNOLOGY
Modules have been described as follows:
Module I: Ultracentrifugation
Module II: Gel electrophoresis
Module III
Module IV
Module V
Hence either Ultracentrifugation and Gel electrophoresis should be deleted or the headings should be as follows:
Module I: Centrifugation

Module II: Gel Electrophoresis
Module III: Chromatography
Module IV: Spectroscopy
Module V: Microscopy and Tracer Techniques

- M.Sc Biotechnology: Domain Electives (DE)

Course Code: MSB232, PHARMACEUTICAL TECHNOLOGY & BIOTECHNOLOGY
'Blood & blood Products': have been included in Module III. It should be part of Module-IV which deals with Blood products.

(4) Mr Mukesh Agarwal , approved of the agenda points telephonically.
(5) Dr Bharat Singh, Dr S. S. Lakhawat& Dr Kumar Sambhav Verma have yet to respond to the BoS-by circulation mail .

(PROF. VINAY SHARMA)
DIRECTOR AIB

(SHRUTI MATHUR)
COORDINATOR - BOS

ADVANCES IN BIOINFORMATICS

Course Code: PBT104 **Credit Unit:03**

Theory

Course Objective:

The course depicts the fundamental concepts and methods in Bioinformatics, a field at the junction of Biology and Computing. The course covers the principles and methods used to search and compare DNA, RNA and proteins, cast as biological "sequences". It also includes three dimensional data of protein structure and the associated problems are structure prediction (secondary and tertiary), analysis of protein structures for clues regarding function, and structural alignment. It serves a gateway course for all science students.

Course Contents:

Module I: Basics of Bioinformatics

Introduction to Bioinformatics; Computers in Biology to understand Biological System; Basic commands of Windows, Unix and Linux operating systems; Concept of open resources in Bioinformatics.

Module II

Biological databases -

Database concepts; Introduction to Data types and source; Protein Sequence and Structural Databases; Nucleic acid databases; Genome databases; Specialized Databases; Protein databases- UniProt, Protein Data Bank. Clinically relevant drug-drug interactions databases; Information retrieval from Biological databases: Entrez system, TCGA data bases, Bioportal.

Module III

Sequence Analysis

Biological background for sequence analysis; Sequence alignment: Global, Local, Pairwise and Multiple sequence analysis; Algorithm for alignments; Database Searching; Tools for Sequence alignment.

Module IV

Introduction to Modeling and Visualization tools

Introduction to RASMOL, PyMoL SWISS-PDB Viewer.

Module V

Insilico Structure prediction of protein and docking

Protein identification, physical properties, motifs and patterns, structure, folding classes, structure classification; Structure databases– PDB and MMDB, visualizing structural information, Docking of Molecules, structure prediction in proteins, prediction of buried residues in proteins, RNA secondary structure – minimum free-energy structures.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Sensen, C.W. (2002). Essentials of Genomics and Bioinformatics, John Wiley and Sons.
- Mount, D.W. (2004). Bioinformatics: Sequence and Genome Analysis. 2nd Ed., Cold Spring Harbor Laboratory Press.
- Baxevanis, A.D. and Ouellette, B.F.F (2009). Bioinformatics: A Practical Guide to the Analysis of Genes and Proteins, Wiley – Interscience

References:

- Gusfield, D. (1997). Algorithms on Strings, Trees, and Sequences: Computer Science and Computational Biology, Cambridge University Press
- Heijne, G. Von and Heijne, G. Von (1987). Sequence Analysis in Molecular Biology: Treasure Trove or Trivial Pursuit by Academic Press.
- Pevzner, P.A. (2000). Computational Molecular Biology: An Algorithmic Approach by MIT Press
- Doolittle, R.F., Abelson, J.N, & Simon, M.I. (1996). Computer Methods for Macromolecular Sequence Analysis, Academic press
- Waterman, M. (1995). Introduction to Computational Biology: Maps, Sequences and Genomes, 1st Ed, Chapman and Hall.

Ron

R Programming

Course Code: BTF 704 **Credit Units: 03**

Course Objective:
R package provides a complete, comprehensive set of tools that can meet the data analysis needs. The course is designed to familiarize students with the skills necessary to produce simple reports and data sets as well as providing an understanding of how R analyses and views data. The students will also work on R which is a language and environment for statistical computing and graphics. provides a wide variety of statistical (linear and nonlinear modelling, classical statistical tests, time-series analysis, classification, clustering, ...) and graphical techniques, and is highly extensible

Course Contents:

Module I: R
Introduction and preliminaries of R, R-packages, Basic Syntax, Data Type, Variables, Operators, numbers and vectors, Objects, their modes and attributes, Ordered and unordered factors, Arrays and matrices, Lists and data frames,

Module II:
R- Charts and Graph: Pie Chart, Bar chart, Histogram, Line Graph, Scattered Graph

Module III:
R - Mean, Median & Mode, R - Linear Regression, R - Multiple Regression, R - Logistic Regression, R - Normal Distribution, R - Binomial Distribution, R - Poisson Regression.

Module III:

R - Analysis of Covariance, R - Time Series Analysis, R - Nonlinear Least Square, R - Decision Tree, R - Random Forest, R - Survival Analysis, R - Chi Square Tests

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Joshua F. Willey and Larry A Pace (2015), Beginning R, Second Addition, Publisher(s): Apress ISBN: 9781484203736

References:

- Garrett Grolemund (2014)Hands-On Programming with R , Publisher: O'Reilly Media, Inc. ISBN: 9781449359010

Annexure 3

SAS (STATISTICAL ANALYSIS SYSTEM) AND MATLAB LAB

Course Code: BTF 723 **Credit Units: 01**

Course Contents:

Module I
Analysis using SAS

Module II
Analysis using Matlab on Bioinformatics toolkit

Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

PYTHON AND MATLAB LAB

Course Code: BTF 723 **Credit Units: 01**

Course Contents:

Module I
Installation and getting use to environment, Analysis using PYTHON

Module II
Analysis using Matlab on Bioinformatics toolkit

Examination Scheme:

IA	EE

Annexure 4

R AND BIOCONDUCTOR LAB

Course Code: BTF 724 **Credit Units: 02**

Course Contents:

Module I
Statistical Analysis using R, GPU computing. Regression, SLR (Simple linear regression), MLR (Multiple linear regression), Testing methods (Z Test, F Test, T Test, Chi Square test)

Module II
Analysis using R packages of Bioconductor, Limma, Affy etc. and their application in Bioinformatics.

Examination Scheme:

IA			EE			
Class Test (Practical Based)	Mid Term Viva	Attendance	Major Experiment	Minor Experiment/Spotting	Practical Record	Viva
15	10	05	35	15	10	10

R- Programming LAB

Course Code: BTF 724 **Credit Units: 02**

Course Contents:

Module I
Statistical Analysis using R, Regression, Testing methods (Z Test, F Test, T Test, Chi Square test)

Module II
R-Chart and Graphs

Examination Scheme:

COMPUTATIONAL PROTEOMICS

Course Code:BTF602 **CreditUnits:03**

Course Objective:
The broad objective of this course is to describe basic principles of protein structure including protein structure motifs, properties of alpha helices and beta sheets and protein folding. The aim is to explain to the students how a protein's conformation determines its biochemical activity, how a protein's structure enables binding to other molecules and how a protein's function can be deduced from its primary structure. It describes the techniques used for solving the 3-D structure of aprotein.

Course Contents:

Module I: Introduction to Proteomics
Introduction to Proteome analysis, 2D-gel electrophoresis, high-throughput proteome analysis with 2D-IEF, chromatography-HPLC, GC; amino acid sequencing, mass spectrometry,

Module II
Structure function relationship
Protein-protein interactions – Large molecular complexes – RNA polymerase II, ribosome; SUMO Protein-protein interactions in health and disease.

Module III
Postranslational modifications – concepts of how protein function is rapidly and dynamically modulated through posttranslational modifications, how posttranslational modifications precede altered transcription levels.

Module IV
Structure determination – experimental and theoretical methods for determination of protein molecular size, X-ray diffraction technique, NMR spectroscopy, Databases for protein structures. Protein Structure Evaluation Methods. (VADAR, Prosa, ProcheckNT, Procheck AQUA).

Module V
Protein Engineering Techniques. ZEBRA, Pocket optimizer, Hot Spot Identification Technique.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

- Introduction to Protein Structure by Carl-Ivar Branden,JohnTooze
- Principles of Protein structure by Schultz, G. E., and Schirmer, R. H.,Proteomics by Daniel C.Leibler
- Proteins: Structures and Molecular Principles (2d ed.). by TECreighton
- Organic spectroscopy by WilliamKemp
- Proteome Research: Two-Dimensional Gel Electrophoresis and Detection Methods (Principles and Practice), T. Rabilloud (Editor), 2000, SpringerVerlag
- Bioinformatics: A practical guide to the analysis of genes and proteins by A.D. Baxevanis and B.F.F. Ouellette. John Wiley and SonsInc.
- Bioinformatics: From Genomes to Drugs by T. Lengauer. John Wiley and SonsInc.
- Bioinformatics: Sequence and Genome Analysis by D.W. Mount. Cold Spring Harbor Laboratory Press
- Database Annotation in Molecular Biology : Principles and Practice by Arthur M.Lesk
- Proteomics by T. Palzkill. Publisher: Kluwer AcademicPublishers

ADVANCED COMPUTATIONAL BIOLOGY - II

Course Code :BTF603 **CreditUnits:03**

Module I
Genomics and Metagenomics: Large scale genome sequencing strategies. Metagenomics, basic principles, applications and interpretation of results. Basic concepts on identification of disease genes, role of bioinformatics-OMIM database, reference genome sequence, Genome mapping and types , gene expression profiling; identification of SNPs, SNP database (DbSNP). Role of SNP in Pharmacogenomics, SNP arrays.

Module II
Protein arrays: basic principles. Computational methods for identification of polypeptides from mass spectrometry. Identification of proteins by PMF and MS/MS data; Database search engines for MS data analysis (Mascot, Sequest, and others);

Module III
Proteomics informatics strategies for biomarker discovery, analysis of protein functions and pathways. Applications of proteomics (Disease diagnosis, drug development, and plant biotechnology). Protein-protein interactions: databases such as DIP, PPI server and tools for analysis of protein-protein interactions.

Module IV
Biological networks: Complex Biological Systems, Types of Biological networks, Intra-cellular networks: Gene-regulatory network, Protein-interaction network, Metabolic networks and Signaling network; Inter-cellular networks: Neuronal networks, Networkmotifs.

Module V
NGS Platforms: Introduction to NGS, Roche/454 FLX, Illumina/Solexa Genome Analyzer, Applied Biosystems SOLiD system, HelicosHeliscope, Pacific Biosciences/single molecule real time (SMRT) sequencing.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:
1. Simpson R. J."Proteins and Proteomics - A Laboratory Manual". Cold Spring Harbour Laboratory Press, 2002.
2. Pennington S. R. and Dunn M. J. "Proteomics - From Protein Sequence to Function. Viva Books,2002.
3. Twyman R. M. "Principles of Proteomics". Taylor & Francis.2004.
4. Principles of Genome Analysis and Genomics (3rd Ed.) by Primrose, S.B. and Twyman,R.M., Blackwell Publishing Company, Oxford, UK.2003.
5. Bioinformatics: Sequence and Genome Analysis by Mount, D., Cold Spring Harbor Laboratory Press, New York.2004.

BIOINFORMATICS ALGORITHMS

Course Code:BTF604 **Credit Units: 03**

Course Objective:
The objective of this course is to provide exposure to students to the broad range of algorithms in the field of bioinformatics. It is important to acquire a knowledge of the algorithms employed in various software systems to understand and evaluate them rather than just use them.

Course Contents:

Module I
Introduction to algorithms, Difference between – Biological vs Computer algorithms, Correct vs Incorrect algorithms, Iterative vs Recursive algorithms, Fast vs Slow algorithms, Tractable vs Intractable problems.

Module II
Big-O notation, Brief about the different types of algorithm design techniques (Exhaustive search, Branch-and-Bound algorithms, Greedy algorithm.

Module III
Dynamic programming, Divide-and-Conquer algorithms, Machine Learning, Randomized algorithms.

Module IV
Neural Network, Hidden Markov Models. SVM, Random Forest, and Various other Classifiers.

Module V
Dynamic programming – its background (sequence alignment – local, global, Gap penalties, scoring of alignments), Needleman-Wunch algorithm, Smith-Waterman algorithm.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

- Algorithms on Strings, Trees, and Sequences: Computer Science and Computational Biology by D. Gusfield. Cambridge UniversityPress
- Bioinformatics:APracticalGuidetotheAnalysisofGenesandProteinsbyA.D.Baxevanisand B.F.F. Quellette. Wiley – interscience.
- Bioinforamtics: Sequence and Genome Analysis by D.W. Mount. Cold Spring Harbor Laboratory Press.
- Essentials of Genomics and Bioinformatics – by C.W. Sensen. John Wiley andSons
- Introduction to Bioinformatics by T. Attwood and D. Parry-Smity. PrenticeHall
- SequenceAnalysisinMolecularBiology:TreasureTroveorTriviablPursuitbyG.VonHeijneand G. Von Heijne. Academic Press.

COMPUTERS – IV

Course Code:BTF605 **Credit Units:02**

Course Objective:
The objective is to introduce students to a modern programming language and help them gain sufficient fluency to undertake research projects with a programming component; to lay the foundations for more advanced study of object-oriented languages
Emphasis is on to understand the basic concepts of programming; to learn the syntax and semantics of Java; to be able to use a program development environment

CourseContents:

CourseContents:

Module I: (Core Java)
Introduction to Java - Features, Inheritance, Strings, Packages , Interfaces; Multi- Threading, Applet Programming: AWT- Components,Menus, Layout manager, etc., Event Handling,Swings , Java Packages - java.util, -java.io; exception handling, JDBC, Introduction to Client Server Application, Java Drivers, java.sql Package, Executing SQL Statements.

Module II
Java Servlets, Introduction to Server Side Application Development, Basics of Servlet Programming, Web Container, Session Tracking, Servlet Context, JSP - Java Server Pages, JSP and Servlets (Differences and Similarity), JSP details -directives, scriplets, expressions, JSPtags.

Module III: Basics of XML
Features & uses of XML.
Parsers, Entities, Attributes
DTD

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

- Complete reference by Herbert SchildtTataMcGrawHill
- Programming with java A Primer by Balagurusamy Publisher: TataMcGrawHill
- The complete Guide to java by Siple.TataMcGrawHill

Rani

GENOMICS LAB

Course Code:BTF621 **Credit Units: 01**

Course Contents:
All the lab. work would be done using Web based tools.

Module I
Comparative genome analysis.

Module II
Databases and web based resources for genomics research and analysis.

Module III
Gene expression profiling & Applications of Gene expression profiling

Module IV
Tools for analysis of human genome

Module V
Web based resources for Microarray Technologies

Examination Scheme:

IA			EE			
Class Test (Practical Based)	Mid Term Viva	Attendance	Major Experiment	Minor Experiment/Spotting	Practical Record	Viva
15	10	05	35	15	10	10

ADVANCES IN BIOINFORMATICS

CourseCode:PBT104 **CreditUnit:03**

Theory

Course Objective:

The course depicts the fundamental concepts and methods in Bioinformatics, a field at the junction of Biology and Computing. The course covers the principles and methods used to search and compare DNA, RNA and proteins, cast as biological "sequences". It also includes three dimensional data of protein structure and the associated problems are structure prediction (secondary and tertiary), analysis of protein structures for clues regarding function, and structural alignment. It serves a gateway course for all sciencestudents.

Course Contents:

Module I: Basics of Bioinformatics

Introduction to Bioinformatics; Computers in Biology to understand Biological System; Basic commands of Windows, Unix and Linux operating systems; Concept of open resources in Bioinformatics.

Module II

Biological databases -

Database concepts; Introduction to Data types and source; Protein Sequence and Structural Databases; Nucleic acid databases; Genome databases; Specialized Databases; Protein databases- UniProt, Protein Data Bank. Clinically relevant drug-drug interactions databases; Information retrieval from Biological databases: Entrez system, TCGA data bases, Bioportal.

Module III

Sequence Analysis

Biological background for sequence analysis; Sequence alignment: Global, Local, Pairwise and Multiple sequence analysis; Algorithm for alignments; Database Searching; Tools for Sequence alignment.

Module IV

Introduction to Modeling and Visualization tools

Introduction to RASMOL, PyMoL SWISS-PDB Viewer.

Module V

Insilico Structure prediction of protein and docking

Protein identification, physical properties, motifs and patterns, structure, folding classes, structure classification; Structure databases– PDB and MMDB, visualizing structural information, Docking of Molecules, structure prediction in proteins, prediction of buried residues in proteins, RNA secondary structure – minimum free-energy structures.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Sensen, C.W. (2002). Essentials of Genomics and Bioinformatics, John Wiley andSons.
- Mount, D.W. (2004). Bioinformatics: Sequence and Genome Analysis. 2nd Ed., Cold Spring Harbor Laboratory Press.
- Baxevanis, A.D. and Ouellette, B.F.F (2009). Bioinformatics: A Practical Guide to the Analysis of Genes and Proteins, Wiley –Interscience

References:

- Gusfield, D. (1997). Algorithms on Strings, Trees, and Sequences: Computer Science and Computational Biology, Cambridge UniversityPress
- Heijne, G. Von and Heijne, G. Von (1987). Sequence Analysis in Molecular Biology: Treasure Trove or Trivial Pursuit by AcademicPress.
- Pevzner, P.A. (2000). Computational Molecular Biology: An Algorithmic Approach by MIT Press
- Doolittle, R.F., Abelson, J.N, & Simon, M.I. (1996). Computer Methods for Macromolecular Sequence .Analysis, Academicpress
- Waterman, M. (1995). Introduction to Computational Biology: Maps, Sequences and Genomes, 1stEd, Chapman andHall.

ADVANCES IN BIOINFORMATICS

CourseCode:PBT104 **CreditUnit:03**

Theory

Course Objective:

The course depicts the fundamental concepts and methods in Bioinformatics, a field at the junction of Biology and Computing. The course covers the principles and methods used to search and compare DNA, RNA and proteins, cast as biological "sequences". It also includes three dimensional data of protein structure and the associated problems are structure prediction (secondary and tertiary), analysis of protein structures for clues regarding function, and structural alignment. It serves a gateway course for all sciencestudents.

Course Contents:

Module I: Basics of Bioinformatics

Introduction to Bioinformatics; Computers in Biology to understand Biological System; Basic commands of Windows, Unix and Linux operating systems; Concept of open resources in Bioinformatics.

Module II

Biological databases -

Database concepts; Introduction to Data types and source; Protein Sequence and Structural Databases; Nucleic acid databases; Genome databases; Specialized Databases; Protein databases- UniProt, Protein Data Bank. Clinically relevant drug-drug interactions databases; Information retrieval from Biological databases: Entrez system, TCGA data bases, Bioportal.

Module III

Sequence Analysis

Biological background for sequence analysis; Sequence alignment: Global, Local, Pairwise and Multiple sequence analysis; Algorithm for alignments; Database Searching; Tools for Sequence alignment.

Module IV

Introduction to Modeling and Visualization tools

Introduction to RASMOL, PyMoL SWISS-PDB Viewer.

Module V

Insilico Structure prediction of protein and docking

Protein identification, physical properties, motifs and patterns, structure, folding classes, structure classification; Structure databases– PDB and MMDB, visualizing structural information, Docking of Molecules, structure prediction in proteins, prediction of buried residues in proteins, RNA secondary structure – minimum free-energy structures.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Sensen, C.W. (2002). Essentials of Genomics and Bioinformatics, John Wiley andSons.
- Mount, D.W. (2004). Bioinformatics: Sequence and Genome Analysis. 2nd Ed., Cold Spring Harbor Laboratory Press.
- Baxevanis, A.D. and Ouellette, B.F.F (2009). Bioinformatics: A Practical Guide to the Analysis of Genes and Proteins, Wiley –Interscience

References:

- Gusfield, D. (1997). Algorithms on Strings, Trees, and Sequences: Computer Science and Computational Biology, Cambridge UniversityPress
- Heijne, G. Von and Heijne, G. Von (1987). Sequence Analysis in Molecular Biology: Treasure Trove or Trivial Pursuit by AcademicPress.
- Pevzner, P.A. (2000). Computational Molecular Biology: An Algorithmic Approach by MIT Press
- Doolittle, R.F., Abelson, J.N, & Simon, M.I. (1996). Computer Methods for Macromolecular Sequence Analysis, Academicpress
- Waterman, M. (1995). Introduction to Computational Biology: Maps, Sequences and Genomes, 1st Ed, Chapman andHall.

ADVANCED FERMENTATION TECHNOLOGY

Course Code: MSD101 **Credit Unit: 03**

Course Objective:
The objective of the course is to apply the principles of biochemical engineering in large scale cultivation of microorganism for production of important products.

Course Contents

Module I
Advantage of bioprocess over chemical process. Basic principle in bioprocess technology. Major agro-industrial waste products used for fermentation, Media formulation sterilization, thermal death kinetics, batch and continuous sterilization system. Modern strain improvement techniques, Sterilization of Industrial Media, Air and Fermenter.

Module II
Transport phenomena in bioprocess – Mass transfer, mass transfer co-efficient for gases and liquids. Rate of oxygen transfer. Determination of oxygen transfer coefficient. Rheological properties of inter-medium. Biological heat transfer, Heat transfer coefficients (it is more of process engineering). Bioprocess control and monitoring variables such as temperature, agitation, pressure, pH etc.

Module III
Kinetics of microbial growth, substrate utilization and product formation Batch, Fed-batch, CSTR types of reactors – CSTR, tower, airlift, bubble column, packed bed, immobilized cells, Control and monitoring, online and off-line control, Computers in bioprocess control systems. Solid state and submerged fermentation process.

Module IV
Industrial production of enzymes and biomolecules: cellulase, amylase, protease; organic acids: citric acid, acetic acid, lactic acid; ethanol, biomass, antibiotics: classification, penicillins, tetracyclins, chloramphenicol; vitamins: B_{12}, riboflavin, Production by batch, continuous and fed batch techniques, isolation, purification and characterization of biomolecules from fermentation media and storage. Major fermentation industries in India and abroad (not that relevant here)

Module V
Biomass: Bakers and distillers yeast production using various raw materials, "bio" factors for growth, Crabtree effect, harvesting, different forms and uses. What are mushroom, different forms of common mushroom production from agro based raw materials and uses. (not part of fermentation) Fermented milk products – Production, purification and packaging of Curd, Cheese, acidophilus milk, Yoghurt, Kefir, Single cell protein (SCP) production. Probiotics and prebiotics; Fermented foods based on milk, meat and vegetables; Fermented beverages.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References reading materials:
Text:

- F Stanbury, Allan Whitaker, Stephen J Hall , Principles of Fermentation Technology, Peter, Aditya Text Pvt. Ltd.
- Casida,Industrial Microbiology, New Age International
- Prescott and Dunn, Industrial Microbiology, C.B.S. Publishers
- J. Waites, Neil L. Morgan, John S. Rockey, Gary Higton, Industrial Microbiology: An Introduction, Michael Blackwell Science Ltd

References:

- Bailley and Ollis, Biochemical Engineering, McGraw Hill Education
- Humphrey, Principles of Biochemical Engineering, Wiley-VCH.

ADVANCED FOOD CHEMISTRY AND NUTRITION

Course Code: MSD102 **Credit Units: 03**

Course Objective:
To acquaint with properties, role of various constituents in foods, interaction and changes during processing and importance of various foods and nutrients in human nutrition.

Course Contents

Module I

Definition and importance of major food constituents, Importance of water in food, Phases of water, Role of water as a solvent in food systems, Concept of water activity and moisture migration.

Module II

Carbohydrates, proteins and lipids: classification, nomenclature, physical, chemical and functional properties and their structural correlations; Major types of starch, Process of starch gelatinization, Process of staling, Modified starches and other polysaccharides used in foods.

Module III

Lipids as emulsifiers, Amino acid and protein interaction, External factors that influence protein systems in foods, Protein modification, Fat replacers; Properties of minerals, vitamins, pigments, flavor components, Interaction of constituents in food systems; Changes during storage and processing; Browning reactions in foods; ~~influences on color, flavor, and texture~~ add auto-oxidation of lipids and rancidity.

Module IV

Food groups and their typical composition; essential nutrients- sources, functions, deficiency diseases; requirements and recommended dietary allowances; digestion, absorption, transport and metabolism of nutrients in human system;

Module V

Food allergy and intolerance, Allergens, toxins and anti-nutritional factors in foods

Examination Scheme:

Components	CT	Attendance	Assignment/Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & Reference reading materials:

Text:

- Belitz HD. Food Chemistry. Springer Verlag.
- DeMan JM, Principles of Food Chemistry. AVI.
- Fennema OR,Food Chemistry.Marcel Dekker.
- Meyer LH, Food Chemistry.CBS.
- Swaminathan M, Essentials of Foods and Nutrition. Vol. II. Ganesh & Co.

INSTRUMENTAL METHODS OF FOOD ANALYSIS

Credits Unit:04

Course Code: MSD103

Course Objectives:

Food analysis is an important component of food technology. This course is based on presenting the basic principles and practice of food analysis. We will be presenting information about how samples are taken, how it is analyzed, and what techniques are being used. The course will have four major components: 1) sample and sampling techniques, 2) spectrophotometric analysis of samples taken 3) chromatography based analysis of food samples, and 4) sample extraction for different techniques. This will include a discussion of principles of different analytical techniques and the recent advancement in food analysis with some case studies.

Course Contents

Module I

Sampling techniques; Water activity, its measurements and significance in food quality; Calibration and standardization of different instruments.

Module II

Spectroscopic techniques using UV/Vis, fluorescence, IR spectroscopy, atomic absorption spectroscopy, polarimetry, refractometry, microscopic techniques in food analysis (SEM, TEM, XRD, particle size analysis). Ultrasonics, NMR, NIR

Module III

Chromatographic techniques: Adsorption, column, partition, affinity, ion exchange, size exclusion, ~~GC,~~ GLC, HPLC, HPTLC, GCMS, LCMS.

Module IV

Separation techniques: Gel filtration, dialysis, electrophoresis, isoelectric focusing, sedimentation, ultrafiltration and ultracentrifugation, solid phase extraction, supercritical fluid extraction,

Module V

Immunoassay techniques; biosensors; thermal methods of food analysis (Differential scanning colorimetry and Differential thermal analysis).

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & Reference reading materials:

Text Book:

- James CS (1998). Analytical chemistry of foods, Blackic Acad, UK.
- Winton, AL (1999). Techniques of food analysis, Allied Science Publication, New Delhi.
- Suzanne Nielson S (2003) Food analysis, Kluwer Academic Press, New York.
- Winton AL (1999) Techniques of food analysis, Allied Science, Official methods of analysis, Association of official analytical chemist USA.

References:

- Song, DWS (1996) Mechanism and theory in food chemistry Champasian and Hall Inc. New York.

ADVANCE FOOD CHEMISTRY AND NUTRITION (LAB)

Course Code: MSD122 **Credit Unit: 01**

Course Objectives:

The objective of this course is to provide the practical exposure to the various chemical analysis methods to know the properties of food. Experiments are designed in such a way that students will carry out the sample extraction and then use the instruments for further analysis of particular analyte.

List of Practical's:

1. Determination of moisture and ash content
2. Determination of protein and fat content
3. Determination of rancidity of oil
4. Determination of minerals (Ca, P, Fe)
5. Estimations of reducing and total sugars
6. Estimations of starch and crude fibre content
7. Determination of calorific value of foods.
8. Determination of BMI & BMR of subject.
9. Case studies for diagnosis of nutritional deficiencies / disorders in human beings.

Examination Scheme:

IA			EE			
Class Test (Practical Based)	Mid Term Viva	Attendance	Major Experiment	Minor Experiment/Spotting	Practical Record	Viva
15	10	05	35	15	10	10

Note: Minor variation could be there depending on the examiner.

INSTRUMENTAL METHODS OF FOOD ANALYSIS (LAB)

Course Code: MSD123 **Credit Unit: 01**

Course Objectives:

The objective of this course is to provide the practical exposure to the students for handling various analytical instruments. Experiments are designed in such a way that students will carry out the sample extraction and then use the instruments for further analysis of particular analyte.

List of Practical's:

1. Determination of protein in given food sample using UV spectrophotometer.
2. Detection of food adulteration in food sample using nanotechnology based colorimetric methods.
3. Detection of glucose in given food sample using lateral flow based strips.
4. Estimation of water activity in food sample using water activity meter.
5. Determination of viscosity using which type ?? viscometer.
6. To determine the color using lovibond tintometer.
7. Demonstration of HPLC and GLC.
8. Demonstration of Flame photometer.
9. Demonstration of electrophoresis.

Examination Scheme:

IA			EE			
Class Test (Practical Based)	Mid Term Viva	Attendance	Major Experiment	Minor Experiment/Spotting	Practical Record	Viva
15	10	05	35	15	10	10

Note: Minor variation could be there depending on the examiner.

Text & Reference reading materials::

Text Book:

- Suzanne Nielson S (2003) Food analysis, Kluwer Academic Press, New York.
- Winton AL (1999) Techniques of food analysis, Allied Science, Official methods of analysis, Association of official analytical chemist USA.

References:

- Song, DWS (1996) Mechanism and theory in food chemistry Champasian and Hall Inc. New York.

COLD CHAIN MANAGEMENT

Course Code: MSD 130 **Credit Units: 03**

Course Objectives:

This course will review major aspects of cold chain management and frozen foods. The area of cold chain is growing worldwide and has emerged as a major trend in the food industry. This course is concentrated in the fundamentals facility storage and application technology for cold chain management. The course gives the knowledge of facilities for the cold chains. It enables the students to understand quality and safety aspects of frozen foods. The course gives the knowledge about various packaging material for frozen foods and packaging machinery.

Course Content

Module I

Introduction to Frozen Food: Introduction to technology of cold chain management, Market demand, current status and future scope of frozen foods. Cold chain integration, energy auditing

Module II

Fundamentals of Freezing: Glass transitions in frozen foods and biomaterials, Microbiology of frozen foods, Thermo physical properties of frozen foods, Freezing loads and Freezing time calculation, Innovations in freezing process

Module III

Facilities for the Cold Chain: Freezing methods and equipment, Cold store design and maintenance, Transportation of frozen foods, Retail display equipment and management, Household refrigerators and freezers, Monitoring and control of the cold chain.

Module IV

Quality and Safety during cold chain: Quality and safety of frozen meat and meat product, Quality and safety of frozen poultry and poultry products, Safety and quality of frozen fish, shellfish, and related products, Quality and safety of frozen vegetables and fruits, Quality and safety of frozen dairy products, Quality and safety of frozen ready meads, Quality and safety of frozen bakery products, Quality and safety of frozen eggs and egg products

Module V

Packaging of Frozen Foods: Introduction to frozen food packaging, Plastic packaging of frozen foods, Paper and card packaging of frozen foods, Packaging of frozen foods with other materials, Packaging machinery

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & Reference reading materials:

Text :

- Quality of Frozen Foods, Erickson, M.C and Hung, Y.C International Thompson Publishing, Newyork
- Handbook of Frozen Foods, Isabel Guerrero Legaretta

Reference:

1. Handbook of Frozen Food Processing and Packaging, Second Edition, Da-Wen Sun, CRC press
2. Managing Frozen foods, Kennedy Chris J CBS, New Delhi.