



SATHYABAMA

**INSTITUTE OF SCIENCE AND TECHNOLOGY
(DEEMED TO BE UNIVERSITY)**

Accredited A++ Grade by NAAC | 12B Status by UGC | Approved by AICTE

www.sathyabama.ac.in

**SCHOOL OF BIO AND CHEMICAL ENGINEERING
CENTRE FOR MOLECULAR AND NANOMEDICAL SCIENCES**

1.1.2 Revision & New Courses Introduced in 2023- 2024

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Board of Studies

Minutes of Meeting (ODD SEM)

Date: 28th April 2023

Time: 11.00AM

Chairperson : **Dr.Ramesh Kumar**

Attendees : **Ms.Sathya V**
Scientific Manager, AffigenixBiosolutions Pvt Ltd.

Dr. Edward

Head of the Department, Department of Biotechnology,
St.Joseph's College (Autonomous), Trichy

Dr.Johnson Retnaraj Samuel S, Internal member

Dr. Jackson Durairaj S, Internal member

Dr.Beryl Vedha Y, Internal member

Board of studies meeting begins with welcome address by the Chairperson. Following discussions were held for approval;

Agenda Item: Review and approval of the course contents for the following courses of 'MSc Medical Biotechnology and Clinical Research' during the academic year 2023-2024.

- Revisions were made in the following courses: Clinical Biochemistry lab practical-I, Microbial Techniques Lab Practical-II, Statistical lab analysis system lab practical.
- Discipline specific new elective course (Systems Biology and Integrative Genomics) has been introduced.

Resolutions: The Board reached a consensus and accorded its endorsement to the curriculum and outline for the above courses. The revised syllabus will be implemented accordingly.

Based on the suggestions given by the members, BoS resolved to recommend the minutes to the Academic Council for further approval.

Internal Member	Designation	Signature
Dr. Edward	Head (External member)	
Ms. SathyaV	Scientific Manager (Industry Expert)	
Dr. Johnson Retnaraj Samuel S	Head	S. Johnson Retnaraj Samuel 28/04/23
Dr. Jackson Durairaj S	Professor	S. Jackson Durairaj 28/4/23
Dr. Beryl Vedha Y	Professor	Y Beryl Vedha 28-04-23

SMBA6101	Clinical Biochemistry lab Practical-I	L	T	P	Credits	Total Marks
		0	2	2	2	100

COURSE OBJECTIVE:

To make the students to understand a broad range of experimental techniques in clinical Biochemistry and to enable them to demonstrate their ability to use the techniques in conducting scientific experiments and observations.

Estimations of clinically relevant analytes Glucose

1. Estimation of plasma glucose;
2. Glucose tolerance test;
3. Stability check of glucose standards

Estimations of clinically relevant lipids

1. Estimation of serum total protein
2. Estimation of serum cholesterol
3. Estimation of serum triglycerides
4. Estimation of HDL cholesterol
5. Estimation of LDL cholesterol
6. Estimation of serum bilirubin
7. Estimation of serum albumin
8. Estimation of serum transaminases
9. Estimation of serum alkaline phosphatase

10. Estimation of SGOT

11. Estimation of serum bicarbonate

Renal Function Tests

1. Estimation of serum alkaline phosphatase
2. Estimation of serum urea
3. Estimation of urea in Urine samples.
4. Estimation of serum creatinine
5. Estimation of creatinine in Urine samples.
6. Determination of serum uric acid

Minerals and Electrolytes

1. Analysis of calculi
2. Estimation of serum calcium
3. Estimation of serum phosphorus
4. Estimation of serum iron
5. Estimation of sodium and potassium

Blood Components

1. RBC, WBC, Platelet count
2. Blood group identification
3. Blood smearing.

TEXT / REFERENCE BOOKS:

1. Practical Clinical Biochemistry methods and interpretations 4th Edition (English, Ranjna Chawla).
2. Varleys Practical Clinical Biochemistry 6th Edition (English, Hardcover, Alan H. Gowenlock).
3. Practical Biochemistry 5th Edition (English, Paperback, R. C. Gupta).
4. Manual of Practical Biochemistry for MBBS 2nd Edition (S. K. Gupta, Veena Singh Ghalaut, Anju Jain).



Added Content

SMBA6102	Microbial Techniques Lab Practical-II	L	T	P	Credits	Total Marks
		0	2	2	2	100

COURSE OBJECTIVE

- To make the students to understand a broad range of experimental techniques in microbiology and to enable them to demonstrate their ability to use the techniques in conducting scientific experiments and observations.

PRACTICALS:

1. Techniques for Isolation microorganisms
 - 1.2 Preservation of microorganisms
 - 2.2 Bacterial staining techniques
2. Microscopic examination of live bacterial population
3. Biochemical Activities of Microorganisms: IMViC, Catalase, and Oxidase.
4. Molecular characterization of microorganisms.
5. Microbiological Analysis of Food products
6. Microbiological Analysis of water
7. Bacterial spore staining
8. Acid-fast staining.
9. Antibiotic Sensitivity Testing
10. Species Identification of unknown bacterial cultures using Molecular Techniques
11. Plating of clinical specimens on media for isolation, purification identification and quantitation
12. Isolation and identification of pathogenic yeasts and moulds and recognition of common laboratory contaminants.
13. Sterilization techniques.
14. Preparation of media; Nutrient broth and Nutrient agar.
15. Optimization for the growth of microorganisms
16. Measurement of growth by cell mass using turbidometer/ photocolrimer/ spectrophotometer

TEXT / REFERENCE BOOKS:

1. Microbiology, Laboratory Manual by Capuccino and Sherman 6th Edition, Pearson Education, (2006).
2. James G. Cappuccino and Natalie Sherman. 2004 (6th edition), Microbiology A Laboratory Manual- Pearson Education.
3. Beister, L.1996. Microbiology in Prattice (6th edition) Adeland Wesley, Langman, New York

SMBA6301	Statistical Analysis System Lab- Practical	L	T	P	Credits	Total Marks
		0	2	2	2	100

COURSE OBJECTIVE:

- To understand the concepts of Statistical Analysis System

LIST OF EXPERIMENTS

Statistical Analysis System (SAS)

1. Understanding DATA Step Processing in SAS.
2. Creating a table using SAS program.
3. Producing Descriptive Statistics using SAS.
4. Producing HTML, PDF and XML Output using SAS
5. Survival Graph using GraphPad Prism tool.
6. Drawing following charts using statistical tools;
 1. Pie chart.
 2. Scatter plot.
 3. Bar diagram (Horizontal and Vertical).
7. Creating a pictogram using given data.
8. Tabulation rules.
9. Data Analysis using Microsoft Excel, SYSTAT and R software.
10. One-way and Two-way ANOVA using Microsoft office excel and Graph Pad prism tools
11. Student T test using Graph Pad prism tools
12. Data Analysis using MATLAB and Minitab

REFERENCE BOOKS:

1. Statistical Methods for Reliability Data. (1998) William Q. Meeker and Luis A. Escobar. Wiley.
2. Survival Analysis Using the SAS System: A Practical Guide. (1995) Paul D. Allison. SAS Institute Inc.

SMBA7006	Systems Biology and Integrative Genomics	L	T	P	Credits	Total Marks
		4	0	0	4	100

COURSE OBJECTIVE:

To provide knowledge on the principles and methodologies of systems biology and integrative genomics and learn to analyse and interpret complex biological data through an integrative approach, employing computational modelling, network analysis, and multi-omics data integration. The students will be equipped to apply systems-level thinking to address biological questions, develop predictive models, and contribute to advancements in personalized medicine and biotechnology.

UNIT: I Introduction to systems biology

12 Hrs

Definition - scope of systems biology - historical evolution -early reductionism - The Human Genome Project - role of computational biology - emergence and complexity - network theory basics- feedback mechanisms and homeostasis - case studies unsuccessful integrations - challenges and opportunities.

UNIT: II Genomic technologies in systems biology

12 Hrs

High-throughput sequencing (HTS) - microarrays and their applications - transcriptomics – RNASeq and differential gene expression analysis- single-cell transcriptomics – proteomics- mass spectrometry techniques - protein-protein interactions - metabolomics - techniques for metabolite profiling- integration with other omics data - data integration and management- databases for omics data.

UNIT: III Modelling biological systems

12 Hrs

Applications of computational models - types of models - deterministic models: ordinary differential equations (ODEs) - stochastic models: Markov processes and Monte Carlo simulations - static vs. dynamic models - model calibration and parameter estimation- techniques for model validation - metabolic network models - gene regulatory network models

UNIT: IV Network biology and pathway analysis

12 Hrs

Introduction - types of biological networks - network construction techniques - experimental approaches: yeast two-hybrid and co-immunoprecipitation - computational approaches - network topology- centrality measures and network motifs - pathway analysis- pathway databases - functional enrichment analysis- identifying drug targets- understanding disease mechanisms through network analysis.

UNIT: V Integrative genomics in health and disease

12Hrs

Need for a systems-level approach - techniques for data integration - applications in cancer genomics

- tumor heterogeneity - biomarker discovery and personalized therapies - autoimmune diseases: a systems perspective-role of artificial intelligence and machine learning -challenges and opportunities in big data analysis.

Max. 60 Hours

COURSE OUTCOMES

On completion of the course, student will be able to

CO1 - Understand the key concepts and principles of systems biology.

CO2 - Use the existing genomic technologies effectively to extract and analyse data.

CO3 - Be capable of integrating multi-omics data using tools and software.

CO4 - Learn the construction and validation of computational models.

CO5 – Apply critical thinking to assess case studies in research and clinical settings.

TEXT / REFERENCE BOOKS:

1. Klipp E, Liebermeister W, Wierling C, Kowald A. Systems biology: a textbook. John Wiley & Sons; 2016.
2. Palsson BØ. Systems biology: properties of reconstructed networks. Cambridge university press; 2006.
3. Alon U. An introduction to systems biology: design principles of biological circuits. Chapman and Hall/CRC; 2019.



New Course



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Date: 27th November 2023

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Scientific Manager, AffigenixBiosolutions Pvt Ltd

Dr. Edward

Head of the Department, Department of Biotechnology,
St.Joseph's College (Autonomous), Trichy

Dr.S. Johnson Retnaraj Samuel, Internal member

Dr.Y. Beryl Vedha, Internal member

Dr. M. Rajasekar, Internal member

The Chairperson welcomed the members. Following discussion were made;

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Dr. Jackson Durairaj S	Professor	S. Jackson Durairaj 27/11/23
Dr.Beryl Vedha Y	Professor	Y Beryl Vedha 27.11.23

SMBA6201	Molecular Biology lab Practical-I	L	T	P	Credits	Total Marks
		0	2	2	2	100

COURSE OBJECTIVE:

- To learn the basic techniques in cell and molecular biology useful for finding the molecular mechanistic roles in biology.

LIST OF EXPERIMENTS

- Agarose Gel Electrophoresis.
- Estimation of DNA and RNA.
- Bacterial genomic DNA isolation.
- Extraction of DNA from Bovine Spleen.
- DNA Extraction from Agarose Gel.
- Bacterial Transformation.
- Phenol Extraction of rRNA (Rat liver).
- Protein sample preparation from bacterial, animal and plant cells.
- Spectrophotometric determination of protein concentration.
- SDS-PAGE.
- Western Blotting techniques.
- Immunofluorescence techniques.
- Total RNA isolation and cDNA conversion.
- Polymerase chain reaction (PCR)
- Real Time PCR (qPCR)
- Overview of Two-Dimensional Gel Electrophoresis.
- Peptide sequencing.
- Plasmid DNA isolation.
- Quantitative and qualitative analysis of plasmid DNA

REFERENCE BOOKS:

- Green, M. R., & Sambrook, J. (2012). Molecular cloning: a laboratory manual.
- Sambrook, J., & Russell, D. W. (2001). Inverse PCR. Molecular Cloning; A Laboratory Manual, 8-81.
- Sambrook, J., Fritsch, E. F., & Maniatis, T. (1989). Molecular cloning (Vol. 1, No. 7.58). New York: Cold spring harbor laboratory press.



SMBA8006	Molecular Diagnostics and Therapeutics	L	T	P	Credits	Total Marks
		4	0	0	4	100

COURSE OBJECTIVE:

To understand the principles and methodologies of molecular diagnostics and therapeutics and to examine their clinical applications in disease diagnosis and treatment. This course aims to prepare students for careers in clinical laboratories, research institutions, and the biotechnology industry, fostering a multidisciplinary approach to patient-centred care and personalized medicine.

Unit: 1 Fundamentals of Molecular Diagnostics

12hrs

Definition - role in early disease detection and management - Key milestones in molecular diagnostics - Polymerase Chain Reaction - Quantitative PCR (qPCR) – applications - next-generation sequencing - sequencing platforms (Illumina, Ion Torrent&PacBio) - clinical applications - microarray technology – types (DNA microarrays, RNA & protein arrays) - gene expression profiling - SNP genotyping - regulatory and ethical considerations.

Unit: 2 Genetic Testing and Screening

12hrs

Types of genetic tests - identification of genetic mutations - case studies of genetic disorders (cystic fibrosis&Huntington's disease)- predictive and carrier testing- familial risk assessment - pharmacogenomics - personalised medicine- NGS in clinical practice - interpretation - challenges in variant interpretation and classification - tools for analyzing genomic data- ethical and social implications of genetic testing - genetic privacy and discrimination - informed consent.

Unit: 3 Biomarkers in Disease Diagnosis

12hrs

Introduction – classifications- types of biomarkers (diagnostic, prognostic&predictive) - importance in personalized medicine - biomarkers in cancer - tumor markers - molecular markers for targeted therapies - biomarker-driven therapies - infectious disease biomarkers - detection of pathogens- biomarkers indicating antimicrobial resistance mechanisms.

Unit: 4 Therapeutic Approaches in Molecular Medicine

12hrs

Definition – scope - targeted therapies - mechanisms of action - gene therapy and genetic modifications - CRISPR and gene editing technologies - RNA-based therapeutics - mechanisms of action for siRNA and antisense oligonucleotides - clinical applications - delivery mechanisms for molecular therapies- challenges and future trends - regulatory, ethical considerations and potential risks.

Unit: 5 Integration of Diagnostics and Therapeutics

12hrs

Companion diagnostics - companion diagnostics in oncology - integrated approaches in patient management- role of artificial intelligence and machine learning in diagnostics - the impact of big data.

Max. 60 Hours

COURSE OUTCOMES

On completion of the course, student will be able to

- CO1 - Understand the basic principles and concepts of molecular diagnosis and therapies.
- CO2 - Analyse the genetic testing data.
- CO3 - Expertise in the identification and role of biomarkers in diagnostics and treatment.
- CO4 - Develop and evaluate molecular diagnostic tools.

TEXT / REFERENCE BOOKS:

1. Grody WW, Nakamura RM, Kiechle FL, Strom C, editors. Molecular diagnostics: techniques and applications for the clinical laboratory. Academic Press; 2009.
2. Ginsburg GS, Willard HF, editors. Essentials of genomic and personalized medicine. Academic Press; 2009.
3. Techniques for Molecular Biology; Tagu D & Moussard C; INRA; 2006
4. Recombinant DNA and Biotechnology; 2nd Ed; Kreuzer H and Massey A; ASM; 2006