



# ALAGAPPA UNIVERSITY



(A State University Established by the Government of Tamil Nadu in 1985  
Accredited with 'A++' Grade by NAAC (CGPA : 3.59) in the Fourth Cycle under Dual  
Mode Category MHRD-NIRF 2024 Rank-47, THE-WUR 202: 601-800, THE ASIA 2024:  
251-300, QS ASIA 2024: 271-280)  
KARAIKUDI -630 003, Tamil Nadu, India

## FACULTY OF SCIENCE DEPARTMENT OF BIOINFORMATICS



### M.Sc. BIOCHEMISTRY VALUE ADDED COURSE

### REGULATIONS AND SYLLABUS

(For the candidates admitted from the  
Academic Year 2025 - 2026)

**M.Sc BIOCHEMISTRY**

(For those who join the Course in July 2025 onwards)

**VALUE ADDED COURSE SYLLABUS**

**[For candidates admitted form the Academic year 2025 onwards]**

|                                |   |                    |
|--------------------------------|---|--------------------|
| Name of the Department         | : | Bioinformatics     |
| Name of the Subject Discipline | : | Biochemistry       |
| Program of Level               | : | M.Sc               |
| Course name                    | : | Value Added Course |

**Introduction:** Value-added courses are part of the curriculum designed to impart the necessary skills to increase employability and equip students with the essential skills to succeed in life. The Department of Bioinformatics offers a variety of value added courses which are conducted after class hours (5.30-6.30 pm). These courses are conducted by in-house staff and help students stand out from the rest in the job market by adding value to their resume. These value-added courses are often independent of each type of department.

**General Objectives of the Program:** The general objective of the M.Sc program in Biochemistry is to develop strong-minded graduates with high-quality skills in the field of biomolecules and enzyme technology. The curriculum designed is to assist the students in understanding the vital concept of fundamentals involved in the structure determination through various Molecular Biology, Biochemical and Cell Biology experimental methods with practical hands-on training in the usage of Bioinformatics tools for Drug Discovery. At the end of the program, the student will gain in-depth knowledge in Biochemistry and play an active role in biological research, government or non-government organization, and private sectors.

**Courses:** ‘Course’ is a component (Department paper) of a programme. Each course offered by the Department is identified by a unique course code. A course contains lectures to meet effectively the teaching and learning needs.

The students have to undergo any one value added course in each semester offered by Department of bioinformatics and the exam should be announced before the end of university exam.

**General Objectives of the Course:**

- To improve employability skills of students.
- To provide an opportunity to students develop their inter-disciplinary skills.
- To bridge the skill gaps and make students industry ready.
- To provide the novel information about form the course to the students.

## **Guidelines for conducting value added courses**

- Value Added Course is not mandatory to qualify for any program.
- It is a teacher assisted learning course open to all students without any additional fee.
- The value added courses may be also conducted class hours (evening 5.30-6.30 pm) .
- A student will be permitted to register only one Value Added Course in each Semester.
- The students may be allowed to take value added courses offered by parent department offering the course.

## **Duration and Venue**

The duration of value added course should not be less than 30 hours.

Value added course shall be conducted in the respective faculty itself.

## **Attendance**

- Each faculty members shall be maintenance of for all courses Attendance and Assessment Record for candidates who have registered for the course.
- The record shall contain details of the students' attendance and marks obtained in the Internal Assessment Tests.
- The record shall be submitted to the Head of the Department once a month for monitoring the attendance and syllabus coverage.
- At the end of the semester, the record shall be duly signed by the Course Instructor and the Head of the Department and placed in safe custody for any future verification.
- Each student shall have a minimum of 75% attendance in all the courses of the particular semester failing which he or she will not be permitted to write the End-Semester Examination.

## **Medium of Instruction**

The medium of instruction is English only.

## **Passing Requirement and Grading**

- The passing requirement for value added courses shall be 40% of the marks prescribed for the course.
- A candidate who has not secured a minimum of 40% of marks in a course (internal and end-term) shall reappear for the course in the next semester/year.
- The grades obtained in course will not be included for calculating the CGPA.

## **Course Completion**

- Learners will get a certificate after they have registered for, written the exam and successfully passed.

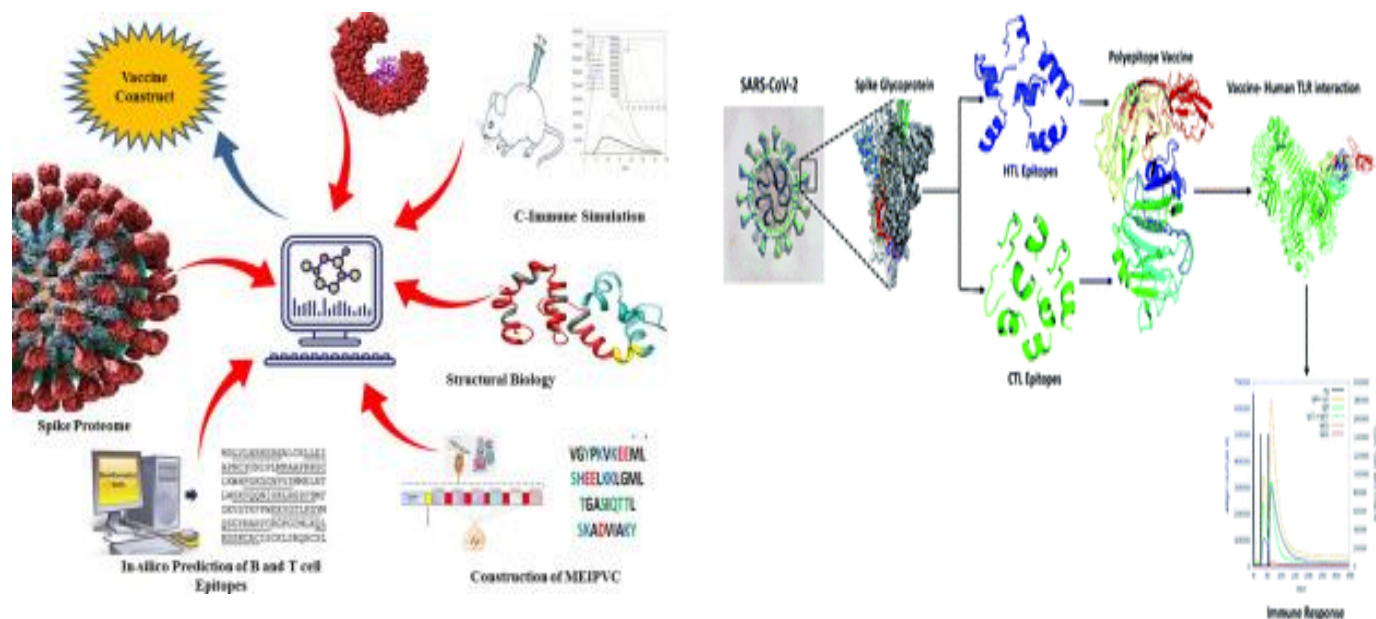
- The students who have successfully completed the Value Added Course shall be issued with a Certificate duly signed by the Authorized signatories.

| S. No             | Paper Code | Title of the Paper                        | Th/Pr | Hrs | Marks |
|-------------------|------------|-------------------------------------------|-------|-----|-------|
| <b>FIRST YEAR</b> |            |                                           |       |     |       |
| 1                 | 25MBCVAC1  | Immunoinformatics                         | Th/Pr | 6   | 50    |
| 2                 | 25MBCVAC2  | Concepts of Chemoinformatics              | Th/Pr | 6   | 50    |
| 3                 | 25MBCVAC3  | Next Generation Sequencing Data Analytics | Th/Pr | 6   | 50    |
| 4                 | 25MBCVAC4  | Animal Physiology                         | Th/Pr | 6   | 50    |
| 5                 | 25MBCVAC5  | Coastal Aquaculture and Mariculture       | Th/Pr | 6   | 50    |
| <b>FIRST YEAR</b> |            |                                           |       |     |       |
| 6                 | 25MBCVAC6  | Recent Techniques in Biophysics           | Th/Pr | 6   | 50    |
| 7                 | 25MBCVAC7  | Medical Coding                            | Th/Pr | 6   | 50    |
| 8                 | 25MBCVAC8  | Food Microbiology                         | Th/Pr | 6   | 50    |
| 9                 | 25MBCVAC9  | Human Anatomy and Physiology              | Th/Pr | 6   | 50    |
| 10                | 25MBCVAC10 | Plant and Animal Biotechnology            | Th/Pr | 6   | 50    |

**Th-Theory, Pr-Practical**

## FIRST YEAR (SEMESTER I<sup>st</sup> & II<sup>nd</sup>)

### Immunoinformatics

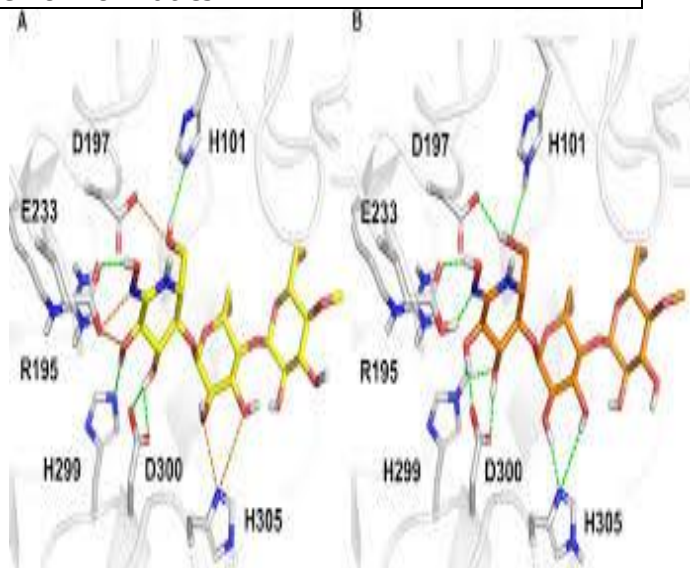
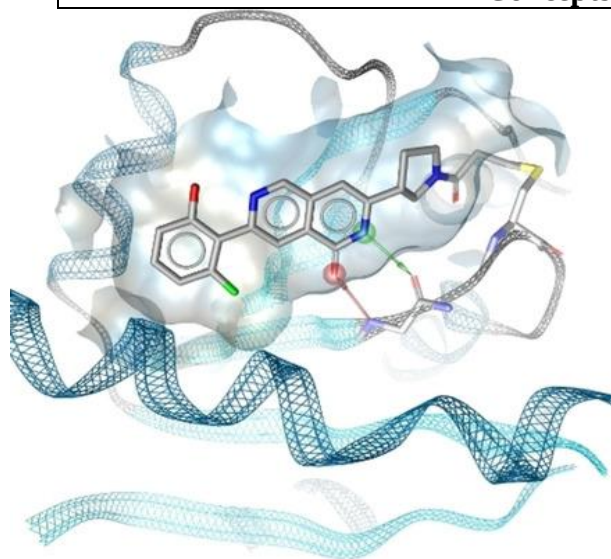


| Value added Course                                                                                                                                                                  |                                                                                                                      |                   |                   |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------|-------------------|-------------------|
| Course Code                                                                                                                                                                         | 25MBCVAC1                                                                                                            | Immunoinformatics | Total Hours<br>30 |
| UNIT-I                                                                                                                                                                              |                                                                                                                      |                   |                   |
| Objective 1                                                                                                                                                                         | To understand the basics and functional knowledge of antigenic protein                                               |                   |                   |
| Functional Analysis of Antigenic Proteins- Prediction of Primary structure, antigenicity, allergic nature of antigenic protein and physiochemical properties of antigenic proteins. |                                                                                                                      |                   |                   |
| Outcome 1                                                                                                                                                                           | Retrieve sequence of the antigenic protein                                                                           |                   |                   |
| UNIT-II                                                                                                                                                                             |                                                                                                                      |                   |                   |
| Objective 2                                                                                                                                                                         | To acquire fundamental knowledge about Antigenic Proteins                                                            |                   |                   |
| Structural Analysis of Antigenic Proteins- Prediction of the secondary structure, domains and important sites in antigenic protein.                                                 |                                                                                                                      |                   |                   |
| Outcome 2                                                                                                                                                                           | Apply structural features of the antigenic proteins like secondary structures, domains, and motifs in vaccine design |                   |                   |
| UNIT-III                                                                                                                                                                            |                                                                                                                      |                   |                   |
| Objective 3                                                                                                                                                                         | Learners understand about the B-cell, epitope, and antigenic proteins                                                |                   |                   |
| Epitope Prediction (B-cell)- Prediction of continuous B-cell epitope, Discontinuous B-cell epitope, glycoprotein antigen epitopes and immunogenic regions in antigenic proteins.    |                                                                                                                      |                   |                   |

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                   |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|
| <b>Outcome<br/>3</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | <b>Analyze various types of epitopes in antigenic proteins</b>                    |
| <b>UNIT-IV</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                   |
| <b>Objective<br/>4</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | <b>Students gain knowledge about epitopes and T cell</b>                          |
| Epitope Prediction (T-cell and MHC)- Prediction of epitopes for T cell, cytotoxic T cells, MHC (class I & II) and T cell epitopes processing. Prediction of Immunogenicity.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                   |
| <b>Outcome<br/>4</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | <b>Model the structure of antigen and antibodies to analyze their interaction</b> |
| <b>UNIT-V</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                                                   |
| <b>Objective<br/>5</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | <b>Analyze the structure of antigens and antibodies and their interaction</b>     |
| Antigen and Antibody Modelling- Automated antigen modelling, Alignment based antigen modelling, Antibody modelling, and Antigen-Antibody Docking.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                   |
| <b>Outcome<br/>5</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | <b>Model the structure of antigen and antibodies to analyze their interaction</b> |
| <b>Suggested Readings:</b> <ol style="list-style-type: none"> <li>1. Darren R Flower, “Immunoinformatics: Predicting Immunogenicity in Silico”, Humana Press, 2007.</li> <li>2. Shoba Ranganathan, Vladimir Brusic, Christian Schonbach, “Immunoinformatics (Immunomics Reviews)” Springer publication.</li> <li>3. Rammensee, “Immunoinformatics - Bioinformatics Strategies for better understanding of Immune Function”, Wiley, 2003.</li> <li>4. Thomas J. Kindt , Barbara A. Osborne, Richard A. Goldsby , “ Kuby Immunology”, WH Freeman, Sixth Edition, 2006.</li> </ol> <b>OnlineResources:</b> <ul style="list-style-type: none"> <li>➤ <a href="https://nptel.ac.in/courses/102/103/102103038/">https://nptel.ac.in/courses/102/103/102103038/</a></li> <li>➤ <a href="https://nptel.ac.in/courses/102/105/102105083/">https://nptel.ac.in/courses/102/105/102105083/</a></li> </ul> |                                                                                   |

| <b>Course Outcome</b>                         | <b>K1</b>            | <b>K2</b>              | <b>K3</b>         | <b>K4</b>           | <b>K5</b>            | <b>K6</b>          |
|-----------------------------------------------|----------------------|------------------------|-------------------|---------------------|----------------------|--------------------|
| <b>CO1</b>                                    | ✓                    | ✓                      | ✓                 | ✓                   | ✓                    |                    |
| <b>CO2</b>                                    | ✓                    | ✓                      | ✓                 | ✓                   | ✓                    |                    |
| <b>CO3</b>                                    | ✓                    | ✓                      | ✓                 | ✓                   | ✓                    |                    |
| <b>CO4</b>                                    | ✓                    | ✓                      | ✓                 | ✓                   | ✓                    |                    |
| <b>CO5</b>                                    | ✓                    | ✓                      | ✓                 | ✓                   | ✓                    |                    |
|                                               | <b>K1 - Remember</b> | <b>K2 - Understand</b> | <b>K3 - Apply</b> | <b>K4 - Analyze</b> | <b>K5 - Evaluate</b> | <b>K6 – Create</b> |
| <b>Course designed by: Dr. J. Jeyakanthan</b> |                      |                        |                   |                     |                      |                    |

## Concepts of Chemoinformatics

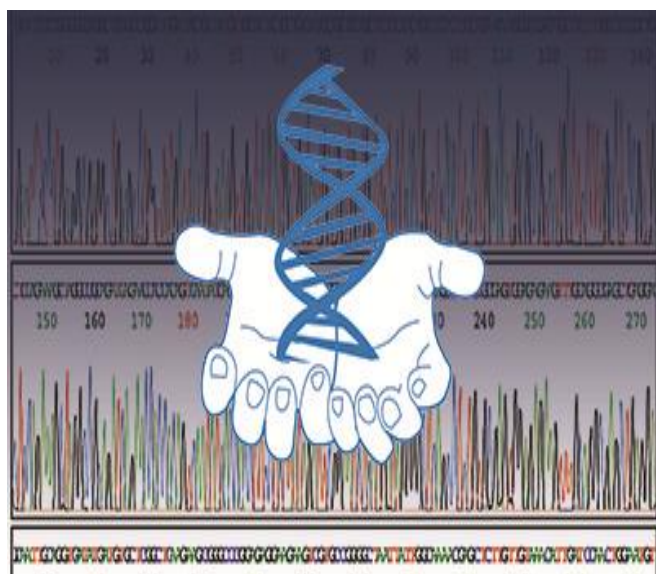


| Value added Course                                                                                                                                                                                                                                                                            |                                                                                                                                                                                                         |                              |                   |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------|-------------------|
| Course Code                                                                                                                                                                                                                                                                                   | 25MBCVAC2                                                                                                                                                                                               | Concepts of Chemoinformatics | Total Hours<br>30 |
| UNIT-I                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                         |                              |                   |
| Objective 1                                                                                                                                                                                                                                                                                   | To understand the basics and applications of cheminformatics in scientific research                                                                                                                     |                              |                   |
| Introduction to Cheminformatics: History, Scope, Evolution, Uses and Prospects of Cheminformatics, Modelling of small molecules and Structure Elucidation, Computational chemistry, use of drug discovery, materials science, environmental chemistry                                         |                                                                                                                                                                                                         |                              |                   |
| Outcome 1                                                                                                                                                                                                                                                                                     | Understand key concepts of cheminformatics and its use in drug discovery, molecular modeling, and related fields                                                                                        |                              |                   |
| UNIT-II                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                         |                              |                   |
| Objective 2                                                                                                                                                                                                                                                                                   | To provide students with a comprehensive understanding of molecular and chemical reaction representations, including graph-theoretical approaches, linear notations, and structural analysis techniques |                              |                   |
| Representation of molecules and chemical reactions: Graph Theoretical Representation of Chemical Structure, Connection Table and Liner Notations, types of notation, Practical Aspects of Structure Searching, Manipulation and Analysis of 2D and 3D Molecular Structures, 3D Pharmacophores |                                                                                                                                                                                                         |                              |                   |
| Outcome 2                                                                                                                                                                                                                                                                                     | Analyze molecular structures and chemical reactions using graph theory, connection tables, and 2D/3D representations including pharmacophores                                                           |                              |                   |
| UNIT-III                                                                                                                                                                                                                                                                                      |                                                                                                                                                                                                         |                              |                   |
| Objective 3                                                                                                                                                                                                                                                                                   | To introduce various chemical and bioactivity databases and highlight their role in cheminformatics research                                                                                            |                              |                   |

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|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Cheminformatics Databases: Importance and role of databases in Cheminformatics, Types of chemical database, Structure-Based Databases; PubChem, ChEMBL, ChEMBank, ChemSpider, ChEBI. Bioactivity and Pharmacological Databases; ChEMBL, ZINC, BindingDB, DrugBank. Reaction and Synthetic Databases; Reaxys and SciFinder, Toxicology and Environmental Databases; EPA CompTox Dashboard, DSSTox, and legacy TOXNET, Literature-Based Databases; SureChEMBL, Google Patents, and Espacenet.                                                                                                                                                                                                                                                                                         |                                                                                                                                                                                          |
| <b>Outcome 3</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | <b>Understand to identify, access, and utilize key cheminformatics databases for chemical structure, bioactivity, reaction, toxicology, and patent-related information</b>               |
| <b>UNIT-IV</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                                                                                          |
| <b>Objective 4</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | <b>To introduce knowledge and practical skills in chemical structure searching, data computation, and molecular visualization tools.</b>                                                 |
| Searching chemical structures: Full structure search, sub-structure search, basic concepts, similarity search, three dimensional search methods, basics of computation of physical and chemical data and structure descriptors, Molecular Drawing and Interactive Visualization; ChemDraw, MarvinSketch, Chimera, RasMol, PyMol, Avogadro, Gaussview.                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                                                                                                                                          |
| <b>Outcome 4</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | <b>Apply various search strategies such as full structure, substructure, and similarity searches; compute molecular descriptors and visualize molecules using cheminformatics tools</b>  |
| <b>UNIT-V</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                          |
| <b>Objective 5</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | <b>To understand the diverse applications of cheminformatics across scientific domains and address key challenges in data interpretation and reproducibility</b>                         |
| Application and Challenges of Cheminformatics: Cheminformatics in drug discovery, environmental chemistry, personalized medicine, materials science, and chemical safety, ADMET prediction, toxicology screening, and chemical reaction informatics. Structure-Activity Relationships, Structure-Property Relationships, Molecular Similarity Searches, Challenges: interpretability, and reproducibility of computational experiments                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                          |
| <b>Outcome 5</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | <b>Evaluate the diverse real-world applications of cheminformatics and critically examine challenges related to data interpretation and reproducibility in computational experiments</b> |
| <b>Suggested Readings</b> <ol style="list-style-type: none"> <li>1. Gasteiger, J., &amp; Engel, T. (2003). <i>Chemoinformatics: A Textbook</i>. Wiley-VCH.</li> <li>2. Leach, A. R., &amp; Gillet, V. J. (2007). <i>An Introduction to Chemoinformatics</i>. Springer.</li> <li>3. Andrew R. &amp; Leach, Valerie Gillet, <i>An Introduction to Chemoinformatics</i> (Springer International, New Delhi, 2009)</li> <li>4. Johann Gasteiger and Thomas Engel. <i>Chemoinformatics-A Textbook</i>. Germany: WileyVCH, 2003.</li> <li>5. Gupta, S. P. (2011). <i>QSAR &amp; Molecular Modeling</i>. New Delhi: Anamaya Pub.</li> <li>6. Bajorath, Juergen, Totowa, N.J. <i>Chemoinformatics: Concepts, Methods, and Tools for Drug Discovery</i>. USA: Humana Press, 2004.</li> </ol> |                                                                                                                                                                                          |

| <b>Course Outcome</b>                   | <b>K1</b>                | <b>K2</b>                  | <b>K3</b>             | <b>K4</b>               | <b>K5</b>                | <b>K6</b>              |
|-----------------------------------------|--------------------------|----------------------------|-----------------------|-------------------------|--------------------------|------------------------|
| <b>CO1</b>                              | ✓                        | ✓                          | ✓                     | ✓                       | ✓                        |                        |
| <b>CO2</b>                              | ✓                        | ✓                          | ✓                     | ✓                       | ✓                        |                        |
| <b>CO3</b>                              | ✓                        | ✓                          | ✓                     | ✓                       | ✓                        |                        |
| <b>CO4</b>                              | ✓                        | ✓                          | ✓                     | ✓                       | ✓                        |                        |
| <b>CO5</b>                              | ✓                        | ✓                          | ✓                     | ✓                       | ✓                        |                        |
|                                         | <b>K1 -<br/>Remember</b> | <b>K2 -<br/>Understand</b> | <b>K3 -<br/>Apply</b> | <b>K4 -<br/>Analyze</b> | <b>K5 -<br/>Evaluate</b> | <b>K6 –<br/>Create</b> |
| <b>Course designed by: Dr. P. Boomi</b> |                          |                            |                       |                         |                          |                        |

## Next Generation Sequencing Data Analytics

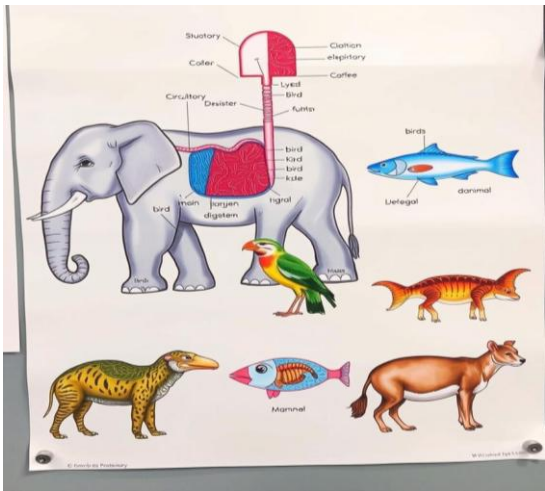


| Value added Course                                                                                                                                                                                           |                                                                                                                                                                                  |                                           |                   |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------|-------------------|
| Course Code                                                                                                                                                                                                  | 25MBCVAC3                                                                                                                                                                        | Next Generation Sequencing Data Analytics | Total Hours<br>30 |
| UNIT-I                                                                                                                                                                                                       |                                                                                                                                                                                  |                                           |                   |
| Objective 1                                                                                                                                                                                                  | Comprehensive understanding of underlying principles of different pipelines, methods and technology involved in NGS that generates massive amounts of DNA or RNA sequencing data |                                           |                   |
| History and Evolutionof sequencing-Different generation Sequencing technologies, Human Genome Project, different NGS platforms, Introduction to NGS technologies: DNA-seq, RNA-seq, ChIP-seq, Hi-seq,MI- Seq |                                                                                                                                                                                  |                                           |                   |
| Outcome 1                                                                                                                                                                                                    | Download the NGS data from various NGS Data sources using SRA toolkit and clean the data using various software                                                                  |                                           |                   |
| UNIT-II                                                                                                                                                                                                      |                                                                                                                                                                                  |                                           |                   |
| Objective 2                                                                                                                                                                                                  | Learners understand about NGS data from various NGS Data sources using SRA toolkit                                                                                               |                                           |                   |
| Preparation and Pre-processing- Library Preparation methods, Sequencing methods, Data formats, Phred quality score, Different Tools for trimming the reads, NGS Data sources, SRA toolkit.                   |                                                                                                                                                                                  |                                           |                   |
| Outcome 2                                                                                                                                                                                                    | Analyze the NGS Data sources, and SRA toolkit                                                                                                                                    |                                           |                   |
| UNIT-III                                                                                                                                                                                                     |                                                                                                                                                                                  |                                           |                   |
| Objective 3                                                                                                                                                                                                  | To outline and compute the transcriptome in any biological sample and identify the differential gene expression through RNAseq                                                   |                                           |                   |
| Gene Prediction and Differential Gene expression- Gene prediction methods, RNA-seq workflow, Data analysis and Visualization using R, GO Annotation Gene Enrichment Analysis, Pathway analysis               |                                                                                                                                                                                  |                                           |                   |

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| <b>Outcome 3</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | <b>Have a detailed knowledge of all the tools used and file generated in the aforementioned steps</b> |
| <b>UNIT-IV</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                                                                       |
| <b>Objective 4</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | <b>To gain knowledge about Whole Genome Sequencing</b>                                                |
| Whole Genome Sequencing- Introduction to DNA assembly, Whole genome and whole exome variant calling pipeline, Variant annotation tools- VCF file and its Visualization tools- Qualimap, IgV, Application of variant calling.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                       |
| <b>Outcome 4</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | <b>Have hands-on experience on various Pipelines involved in DNA seq</b>                              |
| <b>UNIT-V</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                                       |
| <b>Objective 5</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | <b>To understand the basics Metagenomics and function bases analysis</b>                              |
| Single cell RNA sequencing and Metagenomics- Single cell RNA seq, Seurat pipeline, PCA, clustering, Metagenomics- Amplicon Sequencing, Whole genome Metagenomics, Sequence based Metagenomics Analysis; Function based Metagenomics Analysis                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                       |
| <b>Outcome 5</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | <b>Have hands-on experience on RNA seq and Metagenomics Analysis</b>                                  |
| <b>Suggested Readings:</b> <ol style="list-style-type: none"> <li>1. M. J. Bach; The Design of the UNIX Operating System; Pearson Education India, 1st edition.</li> <li>2. R. Durbin; Biological sequence analysis; Cambridge University Press, 1998.</li> <li>3. N. Gautham; Bioinformatics: Databases and Algorithms; Alpha Science, 2006.</li> <li>4. H. Schildt; C – The Complete Reference; McGraw Hill Education, 4th edition, 2017.</li> </ol> <b>OnlineResources:</b> <ul style="list-style-type: none"> <li>➤ DNA seq <a href="https://link.springer.com/article/10.1007/s00439-012-1213-z">https://link.springer.com/article/10.1007/s00439-012-1213-z</a></li> <li>➤ Tux 1 <a href="https://www.nature.com/articles/nprot.2012.016">https://www.nature.com/articles/nprot.2012.016</a></li> <li>➤ Tux 2 <a href="https://www.nature.com/articles/nprot.2016.095">https://www.nature.com/articles/nprot.2016.095</a>.</li> <li>➤ Trinity <a href="https://www.nature.com/articles/nprot.2013.084">https://www.nature.com/articles/nprot.2013.084</a>.</li> <li>➤ Sc-RNA <a href="https://www.singlecellcourse.org/">https://www.singlecellcourse.org/</a></li> </ul> |                                                                                                       |

| Course Outcome                              | K1                   | K2                     | K3                | K4                  | K5                   | K6                 |
|---------------------------------------------|----------------------|------------------------|-------------------|---------------------|----------------------|--------------------|
| CO1                                         | ✓                    | ✓                      | ✓                 | ✓                   | ✓                    |                    |
| CO2                                         | ✓                    | ✓                      | ✓                 | ✓                   | ✓                    |                    |
| CO3                                         | ✓                    | ✓                      | ✓                 | ✓                   | ✓                    |                    |
| CO4                                         | ✓                    | ✓                      | ✓                 | ✓                   | ✓                    |                    |
| CO5                                         | ✓                    | ✓                      | ✓                 | ✓                   | ✓                    |                    |
|                                             | <b>K1 - Remember</b> | <b>K2 - Understand</b> | <b>K3 - Apply</b> | <b>K4 - Analyze</b> | <b>K5 - Evaluate</b> | <b>K6 – Create</b> |
| <b>Course designed by: Dr. M. Jeyakumar</b> |                      |                        |                   |                     |                      |                    |

# Animal Physiology



| Value added Course                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                        |                   |                   |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------|-------------------|-------------------|
| Course Code                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 25MBCVAC4                                                                              | Animal Physiology | Total Hours<br>30 |
| UNIT-I                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                        |                   |                   |
| Objective 1                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | To study the basic physiological principles of digestion, blood and respiratory system |                   |                   |
| Introduction to Physiology: Definition - division of physiology-Relationship of physiology with other science - significance of the study. <b>Digestive system:</b> Nutritional value, Digestion, absorption, energy balance, gastrointestinal enzymes. <b>Blood</b> -Blood corpuscles, plasma function, blood volume and regulation, blood groups, haemoglobin. <b>Respiratory system</b> –Respiratory pigments, transport, and exchange of respiratory gases, waste elimination. |                                                                                        |                   |                   |
| Outcome 1                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Understand the structure and functions of digestion and respiratory system             |                   |                   |
| UNIT-II                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                                        |                   |                   |
| Objective 2                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | To understand the cardiovascular system and excretory system                           |                   |                   |
| Cardiovascular System: Anatomy of heart structure, myogenic heart, ECG-its principle and significance, heart beat and cardiac cycle, blood pressure. <b>Excretory system</b> -kidney, structure and function of nephron, urine formation, urine concentration, waste elimination, regulation of water balance, electrolyte balance, acid – Base balance.                                                                                                                           |                                                                                        |                   |                   |
| Outcome 2                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Critically discuss the types and function of heart and kidney.                         |                   |                   |
| UNIT-III                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                                        |                   |                   |
| Objective 3                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | To clarify the control processes of the muscle, nervous and sensory organs             |                   |                   |

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                             |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------|
| Muscle contraction – General structure and types of muscles. Ultra structure of skeletal muscle. Mechanism of muscle contraction. Chemical changes during muscle contraction. <b>Nervous system</b> - Neurons, nature of nerve impulse–resting potential and action potential, neurotransmitters central and peripheral nervous system, the structure of the synapse, mechanism of synaptic transmission. <b>Sensory organs</b> -Vision, hearing and tactile response.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                             |
| <b>Outcome 3</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | <b>Understand the muscle contraction, nervous system and sensory organs</b> |
| <b>UNIT -IV</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                             |
| <b>Objective 4</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | <b>To educate the homeostatic mechanisms in animals</b>                     |
| Homeostatic Mechanisms - Thermoregulation in poikilotherms and homeotherms –Tolerance to high temperature, cold and freezing-Physiology of hibernation and aestivation. Osmotic and ionic regulation, Hormonal control of osmoregulation: Adaptation to pressure: High altitude-buoyancy.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                                                             |
| <b>Outcome 4</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | <b>Understand the homeostatic mechanisms of animals</b>                     |
| <b>UNIT -V</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                             |
| <b>Objective 5</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | <b>To introduce endocrine systems and animal behavior</b>                   |
| Endocrinology and Animal behavior-Endocrine glands, basic mechanism of hormone action, hormones and diseases. Animal behavior – Biological clock–endogenous rhythm– the circadian rhythm –circannual and lunar periodicity.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                             |
| <b>Outcome 5</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | <b>Acquire knowledge the endocrinology and animal behavior</b>              |
| <b>Suggested Readings:</b> <ol style="list-style-type: none"> <li>1. Linda S. Costanzo. (2017). <i>Physiology</i>, 6th Edition. Elsevier.</li> <li>2. Rastogi, S. T. (1988). <i>Essentials of Animal Physiology</i>. Wiley, Eastern Limited, Madras. Richard W. Hill., Gordon A. Wyse., Anderson, M. (2008). <i>Animal Physiology</i>, 2<sup>nd</sup> edition,</li> <li>3. Richard W. Hill., Gordon A. Wyse., Anderson, M. (2012). <i>Animal Physiology</i>, 3<sup>rd</sup> Edition, Sinauer Associates, Inc.</li> <li>4. Schmidt Nielson, K. (2002). <i>Animal Physiology – Adaptation and Environment</i>, Cambridge Press, Cambridge. Verma, P. S., Tyagi, B. Sand Agarwal, U. V. (2005). <i>Animal Physiology</i>. S. Chand &amp; Company Ltd, New Delhi. Williams S. Hoar. (1966). <i>General and Comparative Physiology</i>.</li> <li>5. Prentice Hall of India, New Delhi.</li> </ol> <b>Online Resources</b> <ul style="list-style-type: none"> <li>➤ <a href="https://nptel.ac.in/courses/102104058">https://nptel.ac.in/courses/102104058</a></li> <li>➤ <a href="https://bio.libretexts.org/Courses/Hanover_College/Comparative_Anatomy_and_Physiology_of_Animals/01%3A_Fundamentals_of_Animal_Physiology">https://bio.libretexts.org/Courses/Hanover_College/Comparative_Anatomy_and_Physiology_of_Animals/01%3A_Fundamentals_of_Animal_Physiology</a></li> </ul> |                                                                             |

| <b>Course Outcome</b>                     | <b>K1</b>            | <b>K2</b>              | <b>K3</b>         | <b>K4</b>           | <b>K5</b>            | <b>K6</b>          |
|-------------------------------------------|----------------------|------------------------|-------------------|---------------------|----------------------|--------------------|
| <b>CO1</b>                                | ✓                    | ✓                      | ✓                 | ✓                   | ✓                    |                    |
| <b>CO2</b>                                | ✓                    | ✓                      | ✓                 | ✓                   | ✓                    |                    |
| <b>CO3</b>                                | ✓                    | ✓                      | ✓                 | ✓                   | ✓                    |                    |
| <b>CO4</b>                                | ✓                    | ✓                      | ✓                 | ✓                   | ✓                    |                    |
| <b>CO5</b>                                | ✓                    | ✓                      | ✓                 | ✓                   | ✓                    |                    |
|                                           | <b>K1 - Remember</b> | <b>K2 - Understand</b> | <b>K3 - Apply</b> | <b>K4 - Analyze</b> | <b>K5 - Evaluate</b> | <b>K6 – Create</b> |
| <b>Course designed by: Dr. M. Mamutha</b> |                      |                        |                   |                     |                      |                    |

## Coastal Aquaculture and Mariculture



| Value added Course                                                                                                                                                                                                                                                                      |                                                                                          |                                     |                   |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------|-------------------------------------|-------------------|
| Course Code                                                                                                                                                                                                                                                                             | 25MBCVAC5                                                                                | Coastal Aquaculture and Mariculture | Total Hours<br>30 |
| Unit -I                                                                                                                                                                                                                                                                                 |                                                                                          |                                     |                   |
| Objective 1                                                                                                                                                                                                                                                                             | To learn the history and status of coastal aquaculture                                   |                                     |                   |
| Coastal aquaculture: History, global and Indian status of coastal aquaculture- Principles of sustainable aquaculture development-Types of culture-candidate species-farm design-infrastructure facilities for shellfish and finfish grow-out farms.                                     |                                                                                          |                                     |                   |
| Outcome 1                                                                                                                                                                                                                                                                               | Students can comprehend national and global status of coastal aquaculture farming system |                                     |                   |
| Unit -II                                                                                                                                                                                                                                                                                |                                                                                          |                                     |                   |
| Objective 2                                                                                                                                                                                                                                                                             | To create awareness of mariculture practices                                             |                                     |                   |
| Mariculture: History, present global and Indian status of Mariculture - Cultivable species-Cage, Pen and raft -site selection - raw materials for constructions- types- design. Mariculture international and national regulation.                                                      |                                                                                          |                                     |                   |
| Outcome 2                                                                                                                                                                                                                                                                               | Students can realize the status of mariculture                                           |                                     |                   |
| Unit -III                                                                                                                                                                                                                                                                               |                                                                                          |                                     |                   |
| Objective 3                                                                                                                                                                                                                                                                             | To train the learners for crustacean farming                                             |                                     |                   |
| Crustacean Farming: Shrimp - crab - lobster. Pond preparation, soil culture – water culture - acclimatization - stocking - water quality - feed and health management - Biosecurity-HACCP and Biofloc technology in shrimp farming. Recirculation aquaculture system(RAS), other recent |                                                                                          |                                     |                   |

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|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------|
| technology for shrimp farming.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                             |
| <b>Outcome<br/>3</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | <b>Students can analyse the shrimp, crab and lobster production</b>         |
| <b>Unit- IV</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                             |
| <b>Objective<br/>4</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | <b>To educate the student on mollusk and seaweed farming</b>                |
| Mollusc and Seaweed Farming: Mussels -oyster-abalone- scallop-pearl oyster culture types of culture - stocking - water quality, feed and health management. Major problems in mollusc farming in India. Seaweed farming and its economical importance.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                             |
| <b>Outcome<br/>4</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | <b>Students can investigate the sustainable mollusk and seaweed farming</b> |
| <b>Unit- V</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                             |
| <b>Objective<br/>5</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | <b>To deliver skills in finfish farming</b>                                 |
| Finfish farming: Cultivable species-types of culture-site selection-pond preparation- soil culture - water culture - stocking - feed - water quality and health management – Recirculating aquaculture system (RAS)- Biofloc technology- Biosecurity procedure for Finfish farming                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                             |
| <b>Outcome<br/>5</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | <b>Students can critically examine the Finfish farming</b>                  |
| <b>Suggested Readings:</b> <ol style="list-style-type: none"> <li>1. Athithan, S. (2021). <i>Coastal Aquaculture and Mariculture</i>. CRC Press.</li> <li>2. David, A. Bengtson (2003). <i>Status of Marine aquaculture in relation to live prey: Past, Present and Future</i>. Blackwell publishing.</li> <li>3. Gerwick Jr., B. C. (2007). <i>Construction of Marine and Offshore Structures</i>. 3<sup>rd</sup> Eds. CRC press, New York.</li> <li>4. Holmer, M., Black, K., Duarte, C. M., Marba, N., Karakassis, I. (2008). <i>Aquaculture in the Ecosystem</i>. Daya Publ. House.</li> <li>5. ICAR (2006). <i>Handbook of Fisheries and Aquaculture</i>. ICAR.</li> <li>6. John E. Bardach (1997). <i>Sustainable Aquaculture</i>. John Wiley &amp; Sons Inc., New York.</li> <li>Korringa, P. (2017). <i>Farming Marine Fishes and Shrimps</i>. United Book Print.</li> </ol> |                                                                             |
| <b>Online resources</b> <ul style="list-style-type: none"> <li>➤ <a href="http://www.fisheries.kerala.gov.in/kavil">http://www.fisheries.kerala.gov.in/kavil</a></li> <li>➤ <a href="http://ecoursesonline.iasri.res.in">http://ecoursesonline.iasri.res.in</a></li> <li>➤ <a href="http://www.cmfri.org.in/">http://www.cmfri.org.in/</a></li> <li>➤ <a href="http://www.ciba.res.in">www.ciba.res.in</a></li> <li>➤ <a href="http://www.fao.org">www.fao.org</a></li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                             |

| <b>Course Outcome</b>                       | <b>K1</b>                | <b>K2</b>                  | <b>K3</b>             | <b>K4</b>               | <b>K5</b>                | <b>K6</b>              |
|---------------------------------------------|--------------------------|----------------------------|-----------------------|-------------------------|--------------------------|------------------------|
| <b>CO1</b>                                  | ✓                        | ✓                          | ✓                     | ✓                       | ✓                        |                        |
| <b>CO2</b>                                  | ✓                        | ✓                          | ✓                     | ✓                       | ✓                        |                        |
| <b>CO3</b>                                  | ✓                        | ✓                          | ✓                     | ✓                       | ✓                        |                        |
| <b>CO4</b>                                  | ✓                        | ✓                          | ✓                     | ✓                       | ✓                        |                        |
| <b>CO5</b>                                  | ✓                        | ✓                          | ✓                     | ✓                       | ✓                        |                        |
|                                             | <b>K1 -<br/>Remember</b> | <b>K2 -<br/>Understand</b> | <b>K3 -<br/>Apply</b> | <b>K4 -<br/>Analyze</b> | <b>K5 -<br/>Evaluate</b> | <b>K6 –<br/>Create</b> |
| <b>Course designed by: Dr. M. Jeyakumar</b> |                          |                            |                       |                         |                          |                        |

## Recent Techniques in Biophysics

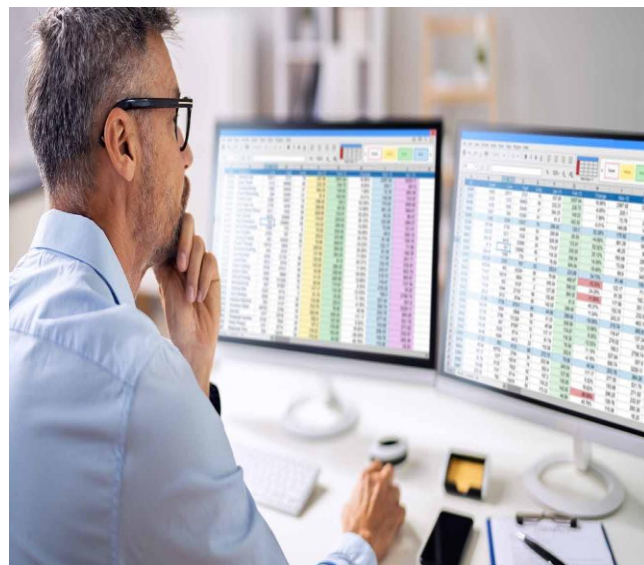


| Value added Course                                                                                                                                                                                                                                                                                 |                                                                                                                                                          |                                 |                   |
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| Course code                                                                                                                                                                                                                                                                                        | 25MBCVAC6                                                                                                                                                | Recent Techniques in Biophysics | Total Hours<br>30 |
| Unit -I                                                                                                                                                                                                                                                                                            |                                                                                                                                                          |                                 |                   |
| Objective 1                                                                                                                                                                                                                                                                                        | Enlighten the students to have a glimpse of recent advances in biophysical techniques                                                                    |                                 |                   |
| Electron Paramagnetic Resonance- External Magnetic Field, Microwave Frequencies, Detection, Hyperfine Coupling, Advantages and Disadvantages, Applications in Biology.                                                                                                                             |                                                                                                                                                          |                                 |                   |
| Outcome 1                                                                                                                                                                                                                                                                                          | Understand the intricacies of future in depth knowledge about the functioning and applications on various biophysical techniques                         |                                 |                   |
| Unit- II                                                                                                                                                                                                                                                                                           |                                                                                                                                                          |                                 |                   |
| Objective 2                                                                                                                                                                                                                                                                                        | Understand the important role of Biophysics for better visualization in scientific Research                                                              |                                 |                   |
| X-ray Protein Crystallography- Technique of Obtaining crystals, Protein production and purification, Crystallization, obtaining x-ray diffraction data, X-ray sources, Sample preparation, X-ray scattering, obtaining an electron density map and Obtaining a three-dimensional model of protein. |                                                                                                                                                          |                                 |                   |
| Outcome 2                                                                                                                                                                                                                                                                                          | Identify the specializations they would like to opt for future and would also enhance their capabilities to understand various cutting-edge technologies |                                 |                   |
| Unit -III                                                                                                                                                                                                                                                                                          |                                                                                                                                                          |                                 |                   |
| Objective 3                                                                                                                                                                                                                                                                                        | To study the important role of Spectroscopy and their applications                                                                                       |                                 |                   |
| Dynamic Force Spectroscopy- Experimental Methods and Applications of Atomic Force Microscope (AFM), Biomembrane Force Probe (BFP).                                                                                                                                                                 |                                                                                                                                                          |                                 |                   |

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|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------|
| <b>Outcome 3</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | <b>Students will be exposed to the techniques and applications of Microscopic instrumentation</b>      |
| <b>Unit- IV</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                                        |
| <b>Objective 4</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | <b>Know-how the Spectroscopic merits and demerits</b>                                                  |
| Raman Spectroscopy and Surface Enhanced Raman Spectroscopy- Advantages and Disadvantages, Applications of Raman Spectroscopy and surface enhanced Raman Spectroscopy in Biology.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                        |
| <b>Outcome 4</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | <b>Have an understanding the Spectroscopic method with relevant scientific terminology</b>             |
| <b>Unit -V</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                        |
| <b>Objective 5</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | <b>Acquire knowledge the Photobiology and Pump</b>                                                     |
| Transient Photobiology- Lasers, Setting up Ultrashort Pulses, Pump-Probe Technique, Applications.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                        |
| <b>Outcome 5</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | <b>It attempts to highlight the necessary information which links basic lasers and probe technique</b> |
| <b>Suggested Readings</b> <ol style="list-style-type: none"> <li>1. Glusker JP and Trueblood KN, 1972. Crystal structure analysis: a primer. Oxford University Press. [Reprint: OUP Oxford, May 27, 2010].</li> <li>2. S Eaton, G. Eaton, 'Electron Paramagnetic Resonance', Ewing's Analytical Instrumentation Handbook. CRC Press.</li> <li>3. Evstigneev, M., et al. Dynamic Force Spectroscopy on Single Molecules. Arizona State University, 2012.</li> <li>4. Eric C. Le Ru, and Pablo G. Etchegoin, <i>Principles of Surface-Enhanced Raman Spectroscopy and related plasmonic effects</i>, First Edition, Elsevier</li> <li>5. Lozovoy, Vadim V., Yair Andegeko, Xin Zhu, and Marcos Dantus. "Applications of Ultrashort Shaped Pulses in Microscopy and for Controlling Chemical Reactions." <i>Chemical Physics</i>: 118-24. Web. 3 Mar. 2015.</li> </ol> <b>Online resources</b> <ul style="list-style-type: none"> <li>➤ <a href="https://phys.libretexts.org/Courses/University_of_California_Davis/UCD%3A_Biophysics_200A_-_Current_Techniques_in_Biophysics">https://phys.libretexts.org/Courses/University_of_California_Davis/UCD%3A_Biophysics_200A_-_Current_Techniques_in_Biophysics</a></li> </ul> |                                                                                                        |

| <b>Course Outcome</b>                         | <b>K1</b>            | <b>K2</b>              | <b>K3</b>         | <b>K4</b>           | <b>K5</b>            | <b>K6</b>          |
|-----------------------------------------------|----------------------|------------------------|-------------------|---------------------|----------------------|--------------------|
| <b>CO1</b>                                    | ✓                    | ✓                      | ✓                 | ✓                   | ✓                    |                    |
| <b>CO2</b>                                    | ✓                    | ✓                      | ✓                 | ✓                   | ✓                    |                    |
| <b>CO3</b>                                    | ✓                    | ✓                      | ✓                 | ✓                   | ✓                    |                    |
| <b>CO4</b>                                    | ✓                    | ✓                      | ✓                 | ✓                   | ✓                    |                    |
| <b>CO5</b>                                    | ✓                    | ✓                      | ✓                 | ✓                   | ✓                    |                    |
|                                               | <b>K1 - Remember</b> | <b>K2 - Understand</b> | <b>K3 - Apply</b> | <b>K4 - Analyze</b> | <b>K5 - Evaluate</b> | <b>K6 – Create</b> |
| <b>Course designed by: Dr. J. Jeyakanthan</b> |                      |                        |                   |                     |                      |                    |

## Medical Coding



| Value added Course                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                            |                |                   |
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| Course Code                                                                                                                                                                                                                                                                                                                                                                                                                     | 25MBCVAC7                                                                                                  | Medical Coding | Total Hours<br>30 |
| UNIT-I                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                            |                |                   |
| Objective 1                                                                                                                                                                                                                                                                                                                                                                                                                     | Identify the attributes needed to become a successful medical coder                                        |                |                   |
| Introduction to Medical Coding- Purpose of Medical Coding, Types of codes and Types of payers. - NCD, LCD, ABN and HIPAA. Medical terminology.                                                                                                                                                                                                                                                                                  |                                                                                                            |                |                   |
| Outcome 1                                                                                                                                                                                                                                                                                                                                                                                                                       | Understand the layout and purpose of the ICD-10-CM coding manual                                           |                |                   |
| UNIT-II                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                                            |                |                   |
| Objective 2                                                                                                                                                                                                                                                                                                                                                                                                                     | Assign diagnosis and procedure codes using the ICD-10 coding manual                                        |                |                   |
| International Classification of Diseases (ICD)- Structure of International Classification of Diseases(ICD), steps to Find ICD 10 CM Code, ICD 10 CM Official Guidelines, Symbols and Conventions, ICD-10 outpatient coding and reporting guidelines, Z-codes. Official instructional notations in the ICD-10-CM. Guidelines for coding physiologic and pathologic conditions involving different organ systems with case study. |                                                                                                            |                |                   |
| Outcome 2                                                                                                                                                                                                                                                                                                                                                                                                                       | Apply the guidelines of ICD-10-CM to code physiologic and pathologic conditions of different organ systems |                |                   |
| UNIT-III                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                            |                |                   |
| Objective 3                                                                                                                                                                                                                                                                                                                                                                                                                     | Learners understand about the Current Procedural Terminology                                               |                |                   |

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                                                             |
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| Current Procedural Terminology (CPT)- Sections of CPT manual, CPT guidelines, CPT code formats, Category I, II, III codes, CPT Conventions and Iconography, Modifiers. Case study.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                                             |
| <b>Outcome<br/>3</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | <b>Evaluate the purpose of CPT manual and national level codes (HCPCS).</b> |
| <b>UNIT-IV</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                             |
| <b>Objective<br/>4</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | <b>To gain knowledge about Healthcare Common Procedure Coding System</b>    |
| Healthcare Common Procedure Coding System (HCPCS)- Introduction to HCPCS manual, levels of HCPCS codes, Groupings of HCPCS codes (A, B, C, D, E, G, H, J, K, L, M, P, Q, R, S, T, or V). Case study.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                             |
| <b>Outcome<br/>4</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | <b>Analyze the difference between Inpatient and outpatient codes</b>        |
| <b>UNIT-V</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                             |
| <b>Objective<br/>5</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | <b>Assign diagnosis and procedure codes using the ICD-10 coding manual</b>  |
| Inpatient Coding- Difference between inpatient and outpatient coding, selection of principal diagnosis, reporting additional diagnosis, present on admission. Development of ICD-10-PCS. Case study.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                             |
| <b>Outcome<br/>5</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | <b>Use ICD-10-CM to assign codes for medical diagnoses</b>                  |
| <b>Suggested Readings:</b> <ol style="list-style-type: none"> <li>1. Senthamarai Selvi and Dhanalakshmi, “Essentials of Bioinformatics and Basics of Medical Coding”, Ryan Publication.</li> <li>2. Buck’s Step-by-Step Medical Coding. Elsevier.</li> <li>3. Sandra L. Johnson and Robin Linker, “Understanding Medical Coding: A Comprehensive Guide”, AAPC publication</li> <li>4. ICD-10-CM 2022: The Complete Official Codebook With Guidelines (ICD-10-CM The Complete Official Codebook), American Medical Association publication.</li> </ol> <b>OnlineResources:</b> <ul style="list-style-type: none"> <li>➤ <a href="https://www.velocityhc.com/wp-content/uploads/2019/09/Step-by-Step-Medical-Coding-2017-Edition-E-Book.pdf">https://www.velocityhc.com/wp-content/uploads/2019/09/Step-by-Step-Medical-Coding-2017-Edition-E-Book.pdf</a></li> </ul> |                                                                             |

| <b>Course Outcome</b>                   | <b>K1</b>            | <b>K2</b>              | <b>K3</b>         | <b>K4</b>           | <b>K5</b>            | <b>K6</b>          |
|-----------------------------------------|----------------------|------------------------|-------------------|---------------------|----------------------|--------------------|
| <b>CO1</b>                              | ✓                    | ✓                      | ✓                 | ✓                   | ✓                    |                    |
| <b>CO2</b>                              | ✓                    | ✓                      | ✓                 | ✓                   | ✓                    |                    |
| <b>CO3</b>                              | ✓                    | ✓                      | ✓                 | ✓                   | ✓                    |                    |
| <b>CO4</b>                              | ✓                    | ✓                      | ✓                 | ✓                   | ✓                    |                    |
| <b>CO5</b>                              | ✓                    | ✓                      | ✓                 | ✓                   | ✓                    |                    |
|                                         | <b>K1 - Remember</b> | <b>K2 - Understand</b> | <b>K3 - Apply</b> | <b>K4 - Analyze</b> | <b>K5 - Evaluate</b> | <b>K6 – Create</b> |
| <b>Course designed by: Dr. P. Boomi</b> |                      |                        |                   |                     |                      |                    |

## Food Microbiology



| Value added Course                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                    |                   |                   |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------|-------------------|-------------------|
| Course Code                                                                                                                                                                                                                                                                                                                                                                                                                                  | 25MBCVAC8                                                                                                                          | Food Microbiology | Total Hours<br>30 |
| UNIT -I                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                                    |                   |                   |
| Objective<br>1                                                                                                                                                                                                                                                                                                                                                                                                                               | To acquire fundamental knowledge about developments of food Microbiology and diverse habitats of microorganisms.                   |                   |                   |
| History and development of Food microbiology: Role and Significance of Microorganisms in Foods, Outline of food spoilage and preservation, Food safety and microbiological Quality Assurance. Micro-organisms and Food Materials-Diversity of Habitat, Micro- organisms in the Atmosphere–Airborne Bacteria, Airborne Fungi, Micro-organisms of Soil, Micro-organisms of Water, Micro-organisms of Plants, Micro-organisms of Animal Origin. |                                                                                                                                    |                   |                   |
| Outcome<br>1                                                                                                                                                                                                                                                                                                                                                                                                                                 | Students remember origin, evolution and scope of food microbiology and exploration of food microbial diversity                     |                   |                   |
| UNIT- II                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                                                                                                                    |                   |                   |
| Objective<br>2                                                                                                                                                                                                                                                                                                                                                                                                                               | To illustrate different growth factors affecting the food microbial incidence and to elucidate the importance of bio preservatives |                   |                   |
| Factors Affecting the Growth and Survival of Micro-organisms in Foods: Microbial Growth, Intrinsic Factors-Nutrient Content, pH and Buffering Capacity, Redox Potential, Antimicrobial Barriers and Constituents, Water Activity and Extrinsic Factors-Relative Humidity, Temperature and Gaseous Atmosphere.                                                                                                                                |                                                                                                                                    |                   |                   |
| Outcome<br>2                                                                                                                                                                                                                                                                                                                                                                                                                                 | Learners understand about the intrinsic and extrinsic factors that influencing the growth and survival of food microbes            |                   |                   |

| UNIT- III                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                          |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Objective<br/>3</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | <b>To construct knowledge on Food safety practices and to create awareness about the impact of food preservation methods</b>                                                                             |
| Microbiology of Food Preservation: Heat Processing, Irradiation, High-pressure Processing–Pascalization, Low-temperature Storage and Chemical Preservatives. Aseptic Packaging, Mano-thermo sonication, Microbiological quality standards of food, FDA, HACCP, ISI, AGMARK.                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                                                          |
| <b>Outcome<br/>3</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | <b>Students can distinguish the significance of various food preservation techniques and familiarize about the food safety management system</b>                                                         |
| UNIT- IV                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                          |
| <b>Objective<br/>4</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | <b>To characterize and classify the complex microbiota of rawmilk and to know the principles of fermented dairy products</b>                                                                             |
| Fermented dairy products: Microbes associated with raw milk: Significance of specific groups of microorganisms in milk-psychrotrophic, mesophilic, thermoduric and thermophilic bacteria–their morphological and biochemical characteristics and classification. Microbial contaminations in rawmilk, and their sources during various stages of production–milking, chilling, storage and transportation with special reference to psychrotrophic microorganisms. Fermented dairy products–microbes fermentation of buttermilk, cream, yogurt, kafil, kumiss, Acidophilous milk and cheese production and its types. |                                                                                                                                                                                                          |
| <b>Outcome<br/>4</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | <b>Learners can critically evaluate the microbiota associated with raw milk and their sources, and gain knowledge on microbial fermentation of dairy products and their potential nutrition benefits</b> |
| UNIT -V                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                                                                                                                                                          |
| <b>Objective<br/>5</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | <b>To educate about foods spoilage and food borne illness in order to protect public health</b>                                                                                                          |
| Food spoilage, preservation and food borne diseases: organism involved in spoilage of fruits and vegetables, cereal and cereal products, meat and meat products. Food borne diseases- Bacterial food borne diseases-( <i>Staphylococcal</i> intoxication, Botulism, Salmonellosis, Shigellosis, EPEC Diarrhoea; Food-borne fungi- Mycotoxins- Aflatoxicosis, Deoxynivalenol, Mycotoxicosis, Ergotism. Food Borne Viral Pathogens-(Norwalkvirus, Reovirus, Rotavirus, Adenovirus, Parvovirus, Hepatitis A Virus)                                                                                                       |                                                                                                                                                                                                          |
| <b>Outcome<br/>5</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | <b>Students can discuss about food deterioration and various food borne diseases-Causes, symptoms and treatment</b>                                                                                      |
| <b>Suggested Readings:-</b> <ol style="list-style-type: none"> <li>Adams, M.R. and Moss, M.O. (2008). <i>Food Microbiology</i>. UK: RSC Publishing, Cambridge</li> <li>Aneja, K.N. (2018). <i>Modern Food Microbiology</i>, Medtec Publisher.</li> </ol>                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                          |

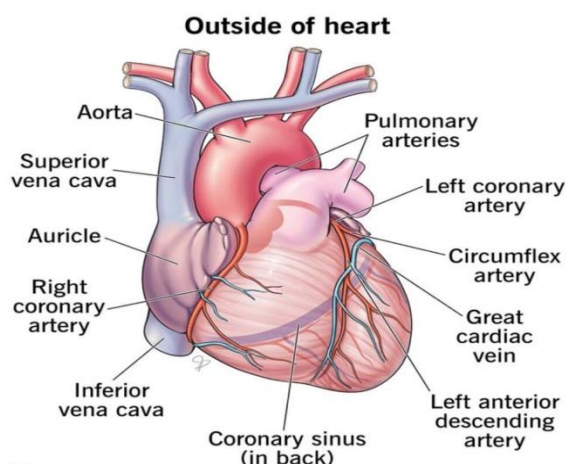
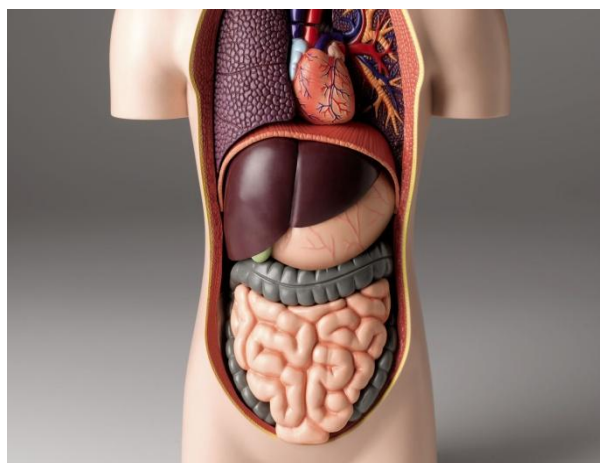
2. Bhatnagar,R.(2017).*FoodMicrobiology*,CrescentPublishingCorporation.
3. BlackburnC.deW.(2006),*Foodspoilagemicroorganisms*.UK:WoodheadPublishing,Cambridge.
4. Cruger,W.andCrueger,A.1995,Biotechnology.BlackWellScientificPublications, Oxford.
5. Deak, T. and Beuchat, L.R. (1996). *Hand Book of Food Spoilage yeasts*, CRC.DickM,(2017).*FoodMicrobiologyAnIntroduction*(2<sup>nd</sup>ed).Bengaluru:Medtech.

**Online resources**

- <https://www.sciencedirect.com/topics/agricultural-and-biological-sciences/food-spoilage>
- <https://www.sciencedirect.com/topics/food-science/food-preservation>

| Course Outcome                       | K1            | K2              | K3         | K4           | K5            | K6          |
|--------------------------------------|---------------|-----------------|------------|--------------|---------------|-------------|
| CO1                                  | ✓             | ✓               | ✓          | ✓            | ✓             |             |
| CO2                                  | ✓             | ✓               | ✓          | ✓            | ✓             |             |
| CO3                                  | ✓             | ✓               | ✓          | ✓            | ✓             |             |
| CO4                                  | ✓             | ✓               | ✓          | ✓            | ✓             |             |
| CO5                                  | ✓             | ✓               | ✓          | ✓            | ✓             |             |
|                                      | K1 - Remember | K2 - Understand | K3 - Apply | K4 - Analyze | K5 - Evaluate | K6 – Create |
| Course designed by: Dr. M. Jeyakumar |               |                 |            |              |               |             |

## Human Anatomy and Physiology



| Value added Course                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                         |                              |                   |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------|------------------------------|-------------------|
| Course Code                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 25MBCVAC9                                                                               | Human Anatomy and Physiology | Total Hours<br>30 |
| Unit -I                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                         |                              |                   |
| Objective 1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Learn the gross morphology, structure and functions of various organs of the human body |                              |                   |
| Structure of Cell, function of each components of the cell, membrane potential, action potential, generation and conduction, electrical stimulation. Blood Cell – composition, origin of RBC, blood groups, estimation of RBC, WBC and platelet. Tissues and histology, embryonic tissue, epithelial tissue, connective tissue, muscle tissue, nervous tissue and tissue membranes. Anatomy of human skin. Functions of skin temperature. Hematopoiesis, Hemoglobin structure and function. Blood bank regulation by skin. |                                                                                         |                              |                   |
| Outcome 1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Acquire knowledge on the cells and tissues                                              |                              |                   |
| Unit- II                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                         |                              |                   |
| Objective 2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Describe the various homeostatic mechanisms and their imbalances                        |                              |                   |
| Structure of heart, pericardium, chambers, major blood vessels, blood supply. Cardiac Cycle, ECG, blood pressure, feedback control for blood pressure. Structure of nervous system, functions of neurons, synapse, reflexes and receptors, brain, brainstem, ventricles and spinal cord, peripheral and automatic nervous system and function of nervous tissue, reflex action, velocity of conduction of nerve impulses, autonomic nervous system.                                                                        |                                                                                         |                              |                   |
| Outcome 2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Understand the structure and functions of various human body systems                    |                              |                   |
| Unit -III                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                                                         |                              |                   |
| Objective 3                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Understand the various tissues and organs of different systems of human body            |                              |                   |

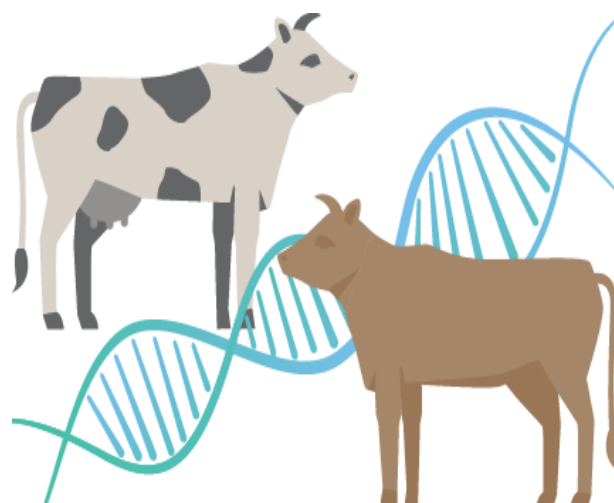
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|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------|
| Parts of respiratory system - trachea and lungs, physiological aspects of respiration, exchange of gases, regulation of respiration, disturbance of respiratory function, pulmonary function test. Organization of GI system, digestion and absorption, movement of GI tract. Accessory organs- liver, spleen and pancreas.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                          |
| <b>Outcome<br/>3</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | <b>Gain knowledge about contribution of each organ system to the maintenance of homeostasis</b>          |
| <b>Unit- IV</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                          |
| <b>Objective<br/>4</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | <b>Know-how the special senses and their tests</b>                                                       |
| General Characteristic and classification of hormone, synthesis, secretion, transport, metabolism and mechanism of action of pituitary, hypothalamus, thyroid, parathyroid, adrenal, pancreas, thymus hormones. Structure and function of reproductive organs, hormones of testes and ovary, hormonal regulation of ovulation, fertilization, implantation, gestation, parturition and lactation, oogenesis, spermatogenesis                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                          |
| <b>Outcome<br/>4</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | <b>Have an understanding the physiological processes accurately with relevant scientific terminology</b> |
| <b>Unit -V</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                                                          |
| <b>Objective<br/>5</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | <b>Acquire the coordinated working pattern of different organs</b>                                       |
| Structure of Kidney and Nephron., Urine formation by kidneys: glomerular filtration, renal blood flow and their control, determinants of glomerular filtration rate (GFR)., Reabsorption and secretion along different parts of nephron., Regulation: regulation of extracellular fluid osmolarity and sodium concentration, role of thirst. Renal regulation of potassium, calcium, phosphate and magnesium, acid- base balance. Olfaction, taste, visual system, hearing and balance.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                                                                          |
| <b>Outcome<br/>5</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | <b>It attempts to highlight the necessary information which links basic sciences and medicine</b>        |
| <b>Reference and Text Books:</b> <ol style="list-style-type: none"> <li>6. Cinnamon L. VanPutte, Jennifer L. Regan and Andrew F. Russo, (2014). Seeley's Anatomy and Physiology, 10<sup>th</sup> edition Publisher: McGraw Hill International.</li> <li>7. Frederic H. Martini, Judi L. Nath and Edwin F. Bartholomew, (2015). Fundamentals of Anatomy and Physiology, 10<sup>th</sup> edition Publisher: Pearson Education Limited.</li> <li>8. Gerard J. Tortora and Bryan Derrickson., (2015) Anatomy and Physiology-Workbook, 1<sup>st</sup> edition Publisher: Wiley India Pvt. Ltd.</li> <li>9. Gerard, T. J., &amp; Bryan, D. (2015). Anatomy &amp; physiology. <i>Indian edition, Wiley India pvt. Ltd., New Delhi</i>, 603-623.</li> <li>10. Martini, F. H., Nath, J. L. &amp; Bartholomew, E. F. (2015). Fundamentals of Anatomy and Physiology. 2001. <i>Pentice Hall: New Jersey</i>, 538-557.</li> <li>11. VanPutte, C. (2016). <i>Seeley's anatomy &amp; physiology</i>. McGraw-Hill Higher Education.</li> <li>12. Bruce, J. Colbert, Jeff, J. ankney and Karen, T, Lee (2020). Anatomy, Phsyiology and Diseases.</li> <li>13. Tobin C.E., "Basic Human Anatomy", McGraw-Hill Publishing Co., Ltd., Delhi 1997</li> </ol> |                                                                                                          |

**Online resources**

- Text Book Of Human Anatomy & Physiology- <https://www.kobo.com/in/en/ebook/text-book-of-human-anatomy-physiology>
- Anatomy and Physiology Books- <https://www.bioexplorer.net/best-anatomy-and-physiology-books.html/>

| Course Outcome                     | K1            | K2              | K3         | K4           | K5            | K6          |
|------------------------------------|---------------|-----------------|------------|--------------|---------------|-------------|
| CO1                                | ✓             | ✓               | ✓          | ✓            | ✓             |             |
| CO2                                | ✓             | ✓               | ✓          | ✓            | ✓             |             |
| CO3                                | ✓             | ✓               | ✓          | ✓            | ✓             |             |
| CO4                                | ✓             | ✓               | ✓          | ✓            | ✓             |             |
| CO5                                | ✓             | ✓               | ✓          | ✓            | ✓             |             |
|                                    | K1 - Remember | K2 - Understand | K3 - Apply | K4 - Analyze | K5 - Evaluate | K6 – Create |
| Course designed by: Dr. M. Mamutha |               |                 |            |              |               |             |

## Plant and Animal Biotechnology



| Value added Course                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                                                          |                                |                   |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------|-------------------|
| Course Code                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 25MBCVAC10                                                                                                                                                                                                                                               | Plant and Animal Biotechnology | Total Hours<br>30 |
| Unit -I                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                                                                                                                                                                                                                                          |                                |                   |
| Objective 1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | To acquire knowledge of plant tissue culture techniques, regeneration processes, Media preparation, and molecular markers for genetic diversity analysis                                                                                                 |                                |                   |
| Plant tissue culture: Basics of tissue culture; Totipotency; Plant regeneration – Organogenesis and Somatic embryogenesis; Establishment of Callus & Cell suspension culture; Media preparation – nutrients & plant hormones; Sterilization techniques; Micropropagation; Somaclonal variation; Cryopreservation – Principle, Methods, and Applications; Synthetic seed production and its applications; Plant cell tissue and organ cultures for phytochemical production- Principle and methods. Biodiversity conservation and Molecular markers(RAPD,ISSR,SCAR and SSR) for Analyzing genetic diversity. |                                                                                                                                                                                                                                                          |                                |                   |
| Outcome 1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | Students will develop proficiency in tissue and cell culture methods, micropropagation, cryopreservation, and synthetic seed production, alongside the ability to utilize molecular markers or genetic diversity assessment and phytochemical production |                                |                   |
| Unit- II                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                                                                                                          |                                |                   |
| Objective 2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | To understand plant genetic engineering principles and various gene transfer techniques                                                                                                                                                                  |                                |                   |
| Plant genetic engineering: Agrobacterium tumefaciens & crown gall tumors. Basis of tumor formation; Ti and Ri plasmids; Mechanism of T-DNA transfer; Disarmed Ti plasmid; Co - integrate, and BinaryTi-plasmid based vectors for plant transformation; Direct gene transfer-PEG-mediated, electroporation, and particle bombardment, Microinjection, Microlaser and Silicon carbide whisker™ methods; Screenable and selectable markers; Genetic Engineering of chloroplast genome and development of transplastomic plants; Strategies for introducing biotic                                              |                                                                                                                                                                                                                                                          |                                |                   |

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                                                                                                                                                                                                                             |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| and abiotic stress responsive genes in plants; Molecular Farming Polyhydroxybutyrate (PHB), Polyfructans & Cyclodextrans. Transgenic crops – FlavrSavr, Bt Cotton, and Golden rice.                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                                                             |
| <b>Outcome 2</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | <b>Students will grasp the basics and mechanisms of transformation methods. Graduates will also recognize the significance of transgenic crops</b>                                                                                                                          |
| <b>Unit -III</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                                                                                                                             |
| <b>Objective 3</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | <b>Top gain an overview of plant and animal genomics, molecular mapping, marker-assisted selection and to explore animal reproductive biotechnology</b>                                                                                                                     |
| Plant and Animal Genomics: Overview of plant and animal genomics, definitions; Arabidopsis Genome Initiative; Molecular mapping and marker assisted selection; Animal reproductive biotechnology and vaccinology                                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                                                                                                                             |
| <b>Outcome 3</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | <b>Students will understand the foundations of plant and animal genomics, with insights into the marker-assisted selection. Graduates will also recognize the significance of animal reproductive biotechnology and its role in advancing vaccinology for animal health</b> |
| <b>Unit- IV</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                                                                                                                                                                                                                             |
| <b>Objective 4</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | <b>To comprehend various methods of gene transfer-physical, chemical, and biological, including recombinant animal viral vectors construction</b>                                                                                                                           |
| <b>Transgenesis:</b> Methods of gene transfer-physical, chemical, and biological methods. Methods for the construction of recombinant animal viral vectors for gene transfer into cell lines. Transgenic animals (Mice, Cows, Pigs, Sheep, Goat, Birds, fish, and Insects). Applications of transgenic animals as disease models (neurodegenerative disorders, carcinogenesis, and hypertension) and production of therapeutic proteins. Cloning for conservation of endangered species; ethical issues in cloning. Gene therapy- <i>Ex vivo</i> and <i>in vivo</i> , viral, and non-viral |                                                                                                                                                                                                                                                                             |
| <b>Outcome 4</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | <b>Students will master techniques for gene transfer, transgenic animal creation, and applications in disease models and therapeutic protein production</b>                                                                                                                 |
| <b>Unit -V</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                             |
| <b>Objective 5</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | <b>To learn the methods of animal cell culture techniques and their applications</b>                                                                                                                                                                                        |
| Animal cell culture: Brief history of animal cell culture; cell culture media and reagents; culture of mammalian cells, tissues, and organs; primary culture, secondary culture, continuous cell lines, suspension cultures; application of animal cell culture for virus isolation and in vitro testing of drugs, testing of toxicity of environmental pollutants in cell culture, applications of cell culture technology in production of human and animal viral vaccines and pharmaceutical proteins                                                                                   |                                                                                                                                                                                                                                                                             |
| <b>Outcome 5</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | <b>Students will acquire animal cell culture proficiency for diverse applications, including virus isolation, drug testing, toxicity assessment, and pharmaceutical protein production, contributing to biomedical research and production sectors</b>                      |
| <b>Suggested Readings:</b> <ol style="list-style-type: none"> <li>1. Chawla, H.S. (2000). Introduction to Plant Biotechnology. Enfield, NH: Science.</li> <li>2. Razdan, M.K. (2003). Introduction to Plant Tissue Culture. Enfield, NH: Science.</li> <li>3. Slater, A., Scott, N.W., &amp; Fowler, M.R. (2008). Plant Biotechnology: an Introduction to Genetic Engineering. Oxford: Oxford University Press.</li> </ol>                                                                                                                                                                 |                                                                                                                                                                                                                                                                             |

4. Buchanan, B. B., Gruissem, W., & Jones, R. L. (2015). *Biochemistry & Molecular Biology of Plants*. Chichester, West Sussex: John Wiley & Sons.
5. Umesha, S. (2013). *Plant Biotechnology*. The Energy And Resources.
6. Glick, B. R., & Pasternak, J. J. (2010). *Molecular Biotechnology: Principles and Applications of Recombinant DNA*. Washington, D. C.: ASM Press.
7. Brown, T. A. (2006). *Gene Cloning and DNA Analysis: an Introduction*. Oxford: Blackwell Pub.
8. Primrose, S. B., & Twyman, R. M. (2006). *Principles of Gene Manipulation and Genomics*. Malden, MA: Blackwell Pub.

**Online Resources:**

- World Wide Web Service and OpenAI

| Course Outcome                       | K1            | K2              | K3         | K4           | K5            | K6          |
|--------------------------------------|---------------|-----------------|------------|--------------|---------------|-------------|
| CO1                                  | ✓             | ✓               | ✓          | ✓            | ✓             |             |
| CO2                                  | ✓             | ✓               | ✓          | ✓            | ✓             |             |
| CO3                                  | ✓             | ✓               | ✓          | ✓            | ✓             |             |
| CO4                                  | ✓             | ✓               | ✓          | ✓            | ✓             |             |
| CO5                                  | ✓             | ✓               | ✓          | ✓            | ✓             |             |
|                                      | K1 - Remember | K2 - Understand | K3 - Apply | K4 - Analyze | K5 - Evaluate | K6 – Create |
| Course designed by: Dr. M. Jeyakumar |               |                 |            |              |               |             |



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