ADVANCED TECHNIQUES IN CLINICAL MICROBIOLOGY

[Value Added Course]

(Effective from the academic year 2020 -2021)

SEMESTER - III

Subject Code	**20ATCM01**	**IA Marks**	**25**
Number of Lecture Hours/Week	**03**	**Exam Marks**	**75**
Total Number of Lecture Hours	**36**	**Exam Hours**	**03**

CREDITS - 02

Course objectives:

1) To learn the basic and advanced techniques in clinical Laboratory.
2) To take up additional skill to handle clinical samples for microbiological analysis

Module 1	**Teaching Hours**
Laboratory Safety: Organization of laboratory and safety precautions in clinical laboratory – Personal hygiene and care – General health care – Vaccination Schedule for technicians – Laboratory care and cautions – Do's and Dont's – lab accidents – Cuts and wounds – Fire Accidents	**12 hours**
Module 2	
Clinical Sample Analysis: Sample collection, processing, preservation and transportation of samples Microscopic Analysis Microscopic analysis of clinical specimens – Urine, Stool, Sputum, Pus, Blood, CSF and other body fluids. **Culture methods:** Culturing and isolation of pathogens from clinical specimens. Culture media – General purpose media – special media – selective media – differential media – transport media.	**12 hours**
Module 3	
Advanced Techniques & Automation: ELISA – PCR-Fluorescence Microscopy – Automated culture systems – automated Blood culture – Automated Urine culture – Automated Antibiotic Sensitivity testing.	**14 hours**

Course outcomes:

At the end of this course, students will be able to,

1) Understand laboratory safety methods.

2) Skilled in handling clinical specimens for microbiological analysis

3) Gain knowledge about automated techniques in Clinical microbiological techniques.

Question paper pattern:

- The question paper will have eight questions.
- Each full Question consisting of 15 marks
- There will be 3 **full** questions (with a **maximum** of **four** sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.
- The students will have to answer 5 full questions, selecting one full question from each module.

Course Chairman:

Prof. Gayathridevara

Department of Studies in Microbiology,

Davangere University, Shivagangothri,

Davangere- 577007, Karnataka – India

References:

1. Ananthanarayanan.R. and Paniker C.K.J Text Book of Microbiology, 9th Edition
   Orient Longman, (2013).
2. James cappuccino, Natalie Sherman.(2004) Microbiology: A Laboratory manual.
3. Ochei. J and A. Kolhatkar, 2000. Medical laboratory science: Theory and Practice, McGraw Hill Education.
4. Sood Ramnik. 2009. Medical Laboratory Technology: Methods and Interpretations. Jaypee Brothers, Medical Publishers Pvt. Limited.
5. Glick, B.J., Pasternak, J.J., Patten, C.L. 1994. Molecular Biotechnology: Principles and Applications of Recombinant DNA, 4th edition, ASM Press.

DAVANGERE UNIVERSITY

Department of Studies in Microbiology, Shivagangothri, Davangere - 577 007

Name of the Program: Value Added Course

Course Code: M.Sc. VA MB02

Name of the Course: Microbial enzymes for greener technology.

Course Credits	No. of Hours per Week	Total No. of Teaching Hours
2 Credits	3 Hrs	36 Hrs
CIA (CCE + IAT)	**SEE**	**Total Marks**
25 Marks	75 Marks	100

Pedagogy: Classrooms lecture, Case studies, Group discussion, Seminar & field work etc.,

Course Objectives:

a) To reduce levels of polluting emission and waste generation thereby protecting or improving the environmental quality.
b) To encourage utilization of residues, recyclable waste and local materials as raw materials for conversion processes
c) To reduce the rate of growth of energy consumption while enhancing economic development.
d) To be equipped with detailed use of enzymes for biofuel using lignocellulosic materials and synthetic polymers.

Course Outcomes: On successful completion of the course, the Students will be able to

a) Gain basic knowledge of the subject will be acquainted with some applied aspects in microbiology to create awareness and more interest in the subject.
b) Equipped with detailed fermentation technology and use of enzymes.
c) In recruiting a job in fermentation based industry.
d) Learn sustainable development by maintaining soil health.
e) Increase the capacity for innovation in development and enhance competitiveness in Green Technology.

Syllabus:	**Hours**
Module No. 1: Microbial enzymes for greener technology	**15**

Introduction to green technology: Water & soil pollution. Ecosystem basics of biogeochemical cycles. Introduction to enzymes, enzyme nomenclature, classification, properties. Screening of enzymes from microbial sources.Microbial enzymes and their role: Oxidoreductases, Microbial oxygenases, Monooxygenases, microbial dioxygenases, Microbial laccase, peroxidases PU hydrolysis. Classification of Peroxidase Enzymes: Lignin peroxidase (Lip), manganese dependent peroxidase, versatile peroxides. Microbial hydrolytic enzymes: microbial lipases, microbial cellulases, microbial proteases, lignocellulose deconstruction and functionalization, bacterial cellulose and nanocelluloses. Microbial enzymes and applications Industries and pollutants, major contaminants in waste water, technologies used for enzymatic treatment of waste water, advantages of enzymatic treatment over other techniques

Module No. 2: Plastics in environmental and biotechnological perspectives on microbial degradation	**04**

Introduction,polymers and microbial degradation, PET,PU,PE,PA,PS,PVC,PP,plastic depolymerisation, biodegradable plastics, plastic wastes in the environment, interaction between microorganisms and plastic, plastic biodegradation process.

Module No. 3: Characterisation and engineering of plastic degrading polyesterases	**04**
Aromatic polyesterase and their structure ,Aliphatic polyesterase, Significance, Techniques in aromatic polyesterase	
Module 4: Microbial degradation and volarization of plastic wastes	**04**
Introduction, Types and properties, Microbial degradation of synthetic polymer, Factors determine microbial degradation of plastics.	
Module5: Biopolymers and plastics	**05**
Analysis of biopolymers, Synthesis and applications of biopolymer composites ,Structural components of plastics (PE, PS, PP, PVC, PUR & PET) and factors determine microbial degradation, plastic eating bacteria, Microorganisms in plastic degrading environments dumpsites.Environmental impact on polymers.	
Module6: Enzymatic bioremediation	**04**
Bioremediation, types of bioremediation – Insitu, Exsitu. Tool to fight environmental pollutants, Enzymes from microbial sources, Microbial enzymes and their relevance in industries, medicine, cosmetics and therapeutic applications, applied biocatalysis.	

Skill Development Activities:

1. Using logic and reasoning to identify the strengths and weakness of alternative solutions, conclusions or approaches to problems regarding microbiology.
2. Understanding the implications of new information for both current and future problem solving and decision making regarding experiments.
3. Analyzing needs and product requirements to create a design.
4. Conducting tests and inspections of products, services or processes to evaluate quality or performance.

Text Books:

1. Vipin Chandra Kalia, 2015. Microbial Factories Volume 2, Springer.
2. Sina Ebnesajjad, 2013. Handbook of Biopolymer and Biodegradable plastics. William Andrew Publications.

Bioinformatics and Insilico drug discovery
[Value Added Course]
(Effective from the academic year 2020 -2021)
SEMESTER - III

Subject Code	20MIB03	IA Marks	25
Number of Lecture Hours/Week	03	Exam Marks	75
Total Number of Lecture Hours	48	Exam Hours	03

CREDITS - 02

Prerequisites for the Course:

- Basic Knowledge of Cell Biology & Genetics
- Biochemistry
- Molecular biology
- Bio-statistics
- Computer Applications

Course objectives:

To provide students with knowledge of Biological databases which are very much essential for understanding modern biology and to introduce some tools to help students to analyze biological data in effective manner

- Biological Databases
- Sequence alignment and database search
- Phylogenetic Analysisand Predictive Methods
- Plasmid mapping and Structure visualization

Module -1	**Teaching Hours**
BIOLOGICAL DATABASES Introduction to bioinformatics, meaning of databases, types of databases. The nucleotide and protein sequence Databases: GenBank, DDBJ and EMBL. Primary and Secondary sequences databases: (SWISS PROT, PIR, NRL3D, PROSITE, PRINTS, BLOCKS and Pfam), ExPASy, Structure databases: Protein Data Bank (PDB), CATH, SCOP. File format, contents, search of databases- Gene bank flat file, PDB flat file, PIR format, FASTA Format. Structure file formats: PDBSUM, PDBLite and MMDB Specialized databases: NCBI-PubMed, PubChem, OMIM, OMIA, Metabolic Pathway-KEGG, EST databases, HPD and SGD databases.	**12 hours**

SEQUENCE ALIGNMENT AND DATABASE SEARCHES Introduction-The evolutionary basis of sequence alignment, the Modular Nature of Proteins. Methods of sequence alignment: Pairwise (Global and Local Alignment) and Multiple Sequence Alignment (MSA). Progressive sequence alignment method, Position Specific Scoring Matrix (PSSM), DOT PLOT method. Optimal Alignment Methods- Dynamic Programming. Internet based analysis tools- Clustal W and T-coffee. Practical issues of alignment, Profiles and Hidden Markov Model, Motif & Patterns. Database similarity searching: BLAST and FASTA, PSI-BLAST & PHI-BLAST, Low complexity regions, Repetitive Elements.	**12 hours**
PHYLOGENETIC ANALYSIS Introduction, concepts of trees, phylogenetic trees and multiple alignments. Distance matrix method (MD), character based methods, methods of evaluating phylogenesis, summary of the phylogenetic methods. Steps in constructing alignments and phylogenesis. Phylogenetic softwares (CLUSTAL W, PHYLIP etc), **PREDICTIVE METHODS** Predictive Methods using Nucleotide sequences: Framework, Masking repetitive DNA, Database searches, Codon Bias Detection, Detecting Functional Sites in the DNA (promoters, transcription factor binding sites, translation initiation sites), Integrated Gene Parsing, finding RNA Genes, Web based tools (GENSCAN, GRAIL, GENEFINDER). Predictive Methods using Protein sequences: Protein Identity based on composition, Physical properties Based on sequence, secondary structure and folding classes, specialized structures or features, tertiary structure. Related web based software (JPRED, PROSEC, NNPREDICT and SOPMA)	**12 hours**
MOLECULAR MODELING, DRUG DESIGN AND DISCOVERY: Generation of Rational Approaches in Drug Design, molecular docking, quantitative structure-activity relationship (QSAR), Receptor Mapping, Estimating Biological Activities, Molecular Interactions: Docking, Calculation of Molecular Properties, Energy Calculations (no derivation), Target identification, Target validation, Modeling, Virtual screening, lead identification, Lead Validation, and Molecular Interactions.	**12 ours**

COURSE OUTCOMES:

- Able to understand the Databases and its types and tools.
- Able to understand the sequence alignment and database searches
- Able to know about phylogenetic analysis.
- Able to understand Restriction mapping and Sequencing methods.
- Able to know applications of insilico modeling in modern biology.
- Able to study insilico drug design

Question paper pattern:

- The question paper will have Eight questions.
- Each full Question consisting of 15 marks
- There will be **2** full questions(with a **maximum** of **four** sub questions)from each module.
- Each full question will have sub questions covering all the topics under a module.

The students will have to answer 5 full questions, selecting one full question from each module.

Course Coordinators:

Dr. Virupakshaiah.DBM

M.Sc., Ph.D., PGD (Bioinfo)

Associate Professor,

Department of Microbiology,

Shivagangothri,

Reference Books:

1.Introduction to Bioinformatics – Arthur Lesk, Oxford, 2006.
2.Bioinformatics – Stuart M Brown, NYU Medical Center, NY USA. 2000.
3.Fundamental Concepts of Bioinformatics – D E Krane& M L Raymer, Pearson, 2006.
4.Computational methods for macromolecular sequence analysis – R F Doolittle. academicPress, 1996.
5.Computational methods in Molecular Biology – S.L.Salzberg, D B Searls, S. Kasif, Elsevier, 1998.
6.Bioinformatics, Methods And Applications– Genomics, Proteomics And Drug discovery – S C Rastogi, n mendiratta& p rastogi, phi, 2006.
7.The molecular modeling perspective in drug design – N Claude Cohen, 1996, Academic Press
8. Analytical Tools for DNA, Genes & Genomes: – ArseniMarkoff, New Age, 2007.

Department of Microbiology

Value Added Course (VAC):

Diversity of Actinobacteria and Bioactive Molecules

(Effective from the academic year 2020 -2021)

SEMESTER - III

Subject Code	**20DABM01**	**IA Marks**	**25**
Number of Lecture Hours/Week	**03**	**Exam Marks**	**75**
Total Number of Lecture Hours	**40**	**Exam Hours**	**03**

CREDITS - 02

Course objectives:

To provide students with knowledge of advanced Bio-prospective of Actinobacterial Research and Technology to build technical competence in industries. Students will be able to learn:

- **Diversity of Actinobacteria**
- **Systematics of Actinobacteria**
- **Biological Potentials of Actinobacteria for Pharmaceutical/Food/Brewery and other Industries**

Module-1	**Teaching Hours**
Diversity of Actinobacteria: Introduction, Actinobacteria: Classification, Characteristics, Life Cycle, Habitat of Actinobacteria: Terrestrial environment, Aquatic environment, Freshwater, Marine water; General characteristics of Actinobacteria: Aerial mycelium , substrate mycelium, Morphological appearance and Economic Importance	**12 hours**
Module-2	
Systematics of Actinobacteria: **Basic biosystematics:** Screening of the prominent isolates of actinobacteria; Characterization of actinobacteria; Biochemical and Physiological properties; Electron microscopic characterization; Antibiotic susceptibility pattern; Antimicrobial attributes; Synthesis of melanin. **Molecular systematics:** Genomic DNA, PCR amplification, 16S rRNA/rDNA, G+C % content determination, Systematic position of the novel isolates **Chemosystematics:** Whole cell sugar, Cell wall amino acids, Cell wall fatty acids, Polar lipids	**14 hours**
Module-3	
Biological Potentials of Actinobacteria for Pharmaceutical/Food/Brewery and other Industries: Bioprospectives of actinobacteria in Pharmaceutical/Food/Brewery and other Industries, Bioactive molecules, Enzymes: Qualitative Screening Quantitative Screening, Enzyme assay and purification, Bioherbicides, Probiotics, Biosurfactants, Vitamins, Pigments, Nanoparticle synthesis, Bioremediation, Control of plant diseases, Enhancement of plant growth, Biolarvicides, Odor and flavor compounds production	**14 hours**

Course outcomes:
On completion of this course, students will have knowledge in:

1. Various areas of Actinobacteria and their bioactive molecules.
2. Scholarly progression and intellectual development the programme aims to equip students with excellence in education and industrial skills.
3. Promoting all round personality development through multi-dimensional education a spirit of self-confidence and self-reliance will be infused.
4. Values of professional ethics and be made ready to contribute to society as responsible individuals.

Question paper pattern:

- The question paper will have eight questions.
- Each full Question consisting of 15 marks
- There will be 3 **full** questions (with a **maximum** of **four** sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.
- The students will have to answer 5 full questions, selecting one full question from each module.

Course Coordinator:

Dr. Shivaveerakumar S.

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Davangere University, Shivagangothri,

Davangere- 577007, Karnataka – India

References:

7. Goodfellow, M. and O'Donnell, A.G., 1993. Roots of bacterial systematics. In Handbook of New Bacterial Systematics (Goodfellow, M. and O'Donnell, A.G., eds), pp. 3-54. Academic Press. London.
8. Korn-Wendisch, F., Kutzner, H.J., 1992. The family Streptomycetaceae. In: The Prokaryotes, A Hand book on the Biology of Bacteria: Ecophysiology, Isolation, Identification, Application. Eds: Balows, A., Truper, H.G., Dworkin,
9. Barka, E.A.; Vatsa, P.; Sanchez, L.; Gaveau-Vaillant, N.; Jacquard, C.; Meier-Kolthoff, J.P.; Klenk, H.P.; Clément, C.; Ouhdouch, Y.; van Wezel, G.P. Taxonomy, physiology, and natural products of Actinobacteria. Microbiol. Mol. Biol. Rev. 2015, 80, 1–43.