अध्ययन मंडल बैठक दिनांक 15/07/2025

विषय – माइक्रोबायोलॉजी

राष्ट्रीय षिक्षा नीति 2020 के अनुरूप विष्वविद्यालय अन्तर्गत संचालित एम.एस,सी. माइक्रोबायोलॉजी में अध्ययन मंडल द्वारा तैयार किये गये तृतीय एवं चतुर्थ सेमेस्टर के पाठ्यक्रम को निम्नानुसार लागू करने की अनुषंसा की जाती है:–

Program : M.Sc. Microbiology									
Course Type	Course Code	Course Title	Paper	Semester	Credits	Max Marks	Min Marks	CIA	ESE
Third Semester									
DSC	MBSC-9T	Research Methodology	T	III	3	100	40	30	70
DSE	MBSE-1T	Biostatistics	T	III	3	100	40	30	70
DSE	MBSE-1T	Advanced Biotechniques	T	III	3	100	40	30	70
DSE	MBSE-1T	Microbial Genetic Engineering	T	III	3	100	40	30	70
DSE	MBSE-2T	Advanced Microbiological Laboratory Techniques in Clinical and Research Applications	T	III	3	100	40	30	70
Fourth Semester									
DSC	MBSC10P	Research Work-Dissertation		IV	20	600	240	180	420

Unit	TOPIC (Course Contents)	No. of Periods	Credit
I	Synopsis Preparation & Plan of work	30	2
II	Research work	120	8
III	Research Writing	120	8
IV	Research Presentation through Viva-Voce	30	2

टीप :– परीक्षा योजना एवं प्रश्न पत्र के प्रारूप को भी यथावत् लागू करने की अनुशंसा की जाती है।

आज दिनांक 15/07/2025 को **माइक्रोबायोलॉजी** अध्ययन मंडल की बैठक में निम्नलिखित अध्यक्ष/सदस्य उपस्थित हुये।

क्र.	नाम	पदनाम	अध्यक्ष/सदस्य	हस्ताक्षर
(1)	डॉ अरविंद अग्रवाल	प्रोफेसर एवं	अध्यक्ष	
(2)	श्रीमती नीतू बसुले पास	सहा. प्राध्यापक	सदस्य	15.7.25
(3)	डॉ. नेलसन खेस	सहा. प्राध्यापक	अध्यक्ष	15.07.25

Part – A: Introduction				
Program:Master In Microbiology		Smemester - III		Session: 2024-25
1	Course Code	MBSC 05T		
2	Course Title	Research Methodology		
3	Course Type	Discipline Specific Elective (DSE)		
4	Prerequisite (If Any)	As per Program		
5	Course Lerning Outcome (CLO)	At the end of this course, student will be able to ➢ Understand the Fundamentals of Research. ➢ Formulate Research Problems and Hypotheses. ➢ Review and Synthesize Literature. ➢ Design Research Methodologies. ➢ Interpret and Present Research Findings. ➢ Demonstrate Ethical Research Practices.		
6	Credit Value	03 Credits	Credit = 15 Hours – Learning and Observation	
7	Total Marks	Max. Marks: 100	Minimum Pass marks – 40	

PART B: CONTENT OF THE COURSE

Total No. of Teaching/Learning Periods: (01 hr. per period) – 45 period (45 Hours)

Unit	TOPIC (Course Contents)	No. of Periods
I	**Research Proposal** : Meaning of Research; Types of Research, The Process of Research; Research, Applications in Social and Business Sciences; Defining the Research Problem, Research Problem and Formulation of Research Hypotheses: Problem Identification Process, Formulating the Research Hypothesis - Types of Research Hypothesis; Contents and Types of Research Proposals.Meaning of Research Designs; Nature and Classification of Research Designs; Exploratory Research Designs: Secondary Resource Analysis, Case Study Method, Expert Opinion Survey, Focus Group Discussions; Descriptive Research Designs: Cross-Sectional Studies and Longitudinal Studies; Experimental Designs.	11
II	**Classification Of Data :** Primary and Secondary Data: Classification of Data; Secondary Data: Uses, Advantages, Disadvantages, Types and Sources; Primary Data Collection: Observation Method, Focus Group Discussion, Personal Interview Method	06
III	**Methodology** : Attitude Measurement and Scaling: Types of Measurement Scales; Attitude; Classification of Scales: Single Item Vs Multiple Item Scale, Comparative Vs Non-Comparative Scales, Measurement Error, Criteria for Good Measurement. Questionnaire Design: Questionnaire Method; Types of Questionnaires; Process of Questionnaire Designing; Advantages and Disadvantages of Questionnaire Method. Sampling: Sampling Concepts - Sample Vs Census, Sampling Vs Non Sampling Error; Sampling Design - Probability and Non Probability Sampling Design; Determination of Sample Size - Sample Size for Estimating Population Mean, Determination of Sample Size for Estimating the Population Proportion. Data Processing: Data Editing - Field Editing, Centralized in House Editing; Coding - Coding Closed Ended Structured Questions, Coding Open Ended Structured Questions; Classification and Tabulation of Data	13
IV	**Research Report :** Research Report Writing: Types of Research Reports - Brief Reports and Detailed Reports; Report Writing: Structure of the Research Report- Preliminary Section, Main Report, Interpretations of Results and Suggested Recommendations; Report Writing: Formulation Rules for Writing the Report: Guidelines for Presenting Tabular Data, Guidelines for Visual Representations. Ethics in Research: Meaning of Research Ethics; Clients Ethical Code; Researchers Ethical Code; Ethical Codes Related to Respondents; Responsibility of Ethics in Research - Uses of Library and Internet in Research.	10
keyword	**Research hypothesis, Sampling, Research ethics, Research report**	

Name and Signature of Convener and Members of CBoS

Dr. Arvind Agarwal

15/7/25

Dr. Nelson Xess

Neetu (Wasnik) Das

Part – C : Learning Resources

Text Books, Reference Books and Others

Text Book Recommended :

1. **Research Methodology: Methods and Techniques"** by **C.R. Kothari and Gaurav Garg**
2. **Business Research Methods"** by **Donald R. Cooper and Pamela S. Schindler**
3. **Research Methods for the Behavioral Sciences"** by **Frederick J. Gravetter and Lori-Ann B. Forzano**
4. **Social Research Methods"** by **Alan Bryman**
5. **The Craft of Research"** by **Wayne C. Booth, Gregory G. Colomb, and Joseph M. Williams**

Reference Books :

1. **Uma Sekaran and Roger Bougie – *Research Methods for Business: A Skill-Building Approach***
2. **Ranjit Kumar – *Research Methodology: A Step-by-Step Guide for Beginners***
3. **William G. Zikmund – *Business Research Methods***

Online Resources – e-Resources/e-Books and e-learning portals

1. https://ndl.iitkgp.ac.in/
2. https://www.researchgate.net/
3. https://swayam.gov.in/
4. https://www.coursera.org/courses?query=research%20methods

Part – D : Assessment and Evaluation

Suggested Continuous Evaluation Methods :
Maximum Marks : 100 Marks
Continuous Internal Assessment : 30 Marks
End Semester Exam : 70 Marks

Continuous Internal Assessment (CIA): (By Course Teacher)	Internal Test/Quiz - **(2)** : Assignement/Seminar – Total Marks -	**20+20** **10** **30**	Better Marks out of the two Test/Quiz + Obtained marks in Assignment Shall be Considered against **30** marks
End Semester Exam (ESE) :	**Two Section – A & B** **Section A : Q1. Objective 10 × 1 = 10 Mark, Q2. Short answer type - 5×4 = 20 Marks** **Section B : Descriptive answer type qts., 1 out of 2 from each unit - 4×10 = 40 Marks**		

Name and Signature of Convener and Members of CBoS

Dr. Arvind Agrawal

15/7/25
Neetu (Wasnik) Das

Dr. Nelson Xess

Part – A: Introduction			
Program:Master In Microbiology		Smemester - III	Session: 2024-25
1	Course Code	MBSE-1~~7~~T	
2	Course Title	Biostatistics	
3	Course Type	Discipline Specific Elective (DSE)	
4	Prerequisite (If Any)	As per Program	
5	Course Lerning Outcome (CLO)	At the end of this course, student will be able to ➢ Understand and Apply Core Biostatistical Concepts. ➢ Perform Statistical Tests and Interpret Results. ➢ Use Modern Statistical Tools and Software. ➢ Analyze and Visualize Microbiological Data. ➢ Integrate Statistical Thinking into Research Design. ➢ Adopt Ethical and Accurate Reporting Practices.	
6	Credit Value	03 Credits	Credit = 15 Hours – Learning and Observation
7	Total Marks	Max. Marks: 100	Minimum Pass marks – 40

PART B: CONTENT OF THE COURSE

Total No. of Teaching/Learning Periods: (01 hr. per period) – 45 period (45 Hours)

Unit	TOPIC (Course Contents)	No. of Periods
I	**Fundamentals of Biostatistics**: Introduction to Biostatistics: Scope and applications in Microbiology, Types of Data: Qualitative vs Quantitative, Scales of Measurement, Data Presentation: Tables, Graphs, Histograms, Frequency Distribution, Measures of Central Tendency: Mean, Median, Mode, Measures of Dispersion: Range, Variance, Standard Deviation, Coefficient of Variation, Introduction to data cleaning and normalization	10
II	**Probability and Distributions:** Basic Probability: Concepts, Rules, and Applications, Probability Distributions: Binomial, Poisson, Normal, Sampling Methods: Simple random, stratified, systematic, cluster sampling, Central Limit Theorem and its implications, Standard Error, Confidence Interval, F-test, Z-test and t-test (One and two sample problems)	10
III	**Hypothesis Testing and Correlation** : Hypothesis formulation: Null and Alternative, Statistical Tests: Chi-square test (goodness of fit, test of independence), ANOVA (One-way and Two-way), Post-hoc tests, Correlation: Pearson and Spearman methods, Regression Analysis: Simple and Multiple Linear Regression	12
IV	**Advanced Biostatistics and Modern Tools:** Non-parametric tests: Mann-Whitney U, Kruskal-Wallis, Wilcoxon tests, Bioinformatics data analysis basics: Understanding sequence data statistics, Meta-analysis basics: Forest plot interpretation, Introduction to Machine Learning for Microbiology (supervised vs unsupervised models), Data Visualization techniques, Introduction to Statistical Reporting: APA and scientific formats, SPSS, R (tidyverse, ggplot2), Python (scikit-learn for machine learning), Bioinformatics Toolkits: MEGA, BLAST statistical scores, Online Platforms: BioRender, Tableau Public, GraphPad Prism	13
keyword	Data cleaning, F-test, Post-hoc tests, MEGA	

Name and Signature of Convener and Members of CBoS

Dr. Arvind Agrawal
AIR

15/7/25

Dr. Nelson Xess

Heetw(Hetu)Das

Part – C : Learning Resources

Text Books, Reference Books and Others

Text Book Recommended :

1. **Biostatistics: A Foundation for Analysis in the Health Sciences by *Author*: Wayne W. Daniel, Chad L. Cross**
2. **Primer of Biostatistics by *Author*: Stanton A. Glantz**
3. **Biostatistics for the Biological and Health Sciences by *Author*: Marc M. Triola, Mario F. Triola**
4. **Introduction to Bioinformatics by *Author*: Arthur M. Lesk**
5. **Practical Statistics for Medical Research by *Author*: Douglas G. Altman**
6.

Reference Books :

1. **Biostatistical Analysis– *Jerrold H .Zar***
2. **Statistical Methods for Psychology – David C. Howell**
3. **An Introduction to Statistical Learning – Gareth James, Daniela Witten, Trevor Hastie, Robert Tibshirani**

Online Resources – e-Resources/e-Books and e-learning portals

1. https://ndl.iitkgp.ac.in/
2. https://www.researchgate.net/
3. https://swayam.gov.in/
4. https://www.coursera.org/courses?query=research%20methods
5. https://www.edx.org/
6. https://www.khanacademy.org/math/statistics-probability

Part – D : Assessment and Evaluation

Suggested Continuous Evaluation Methods :
Maximum Marks : 100 Marks
Continuous Internal Assessment : 30 Marks
End Semester Exam : 70 Marks

Continuous Internal Assessment (CIA): (By Course Teacher)	Internal Test/Quiz - **(2)** :	**20+20**	Better Marks out of the two Test/Quiz + Obtained marks in Assignment Shall be Considered against **30** marks
	Assignement/Seminar –	**10**	
	Total Marks -	**30**	
End Semester Exam (ESE) :	**Two Section – A & B** **Section A : Q1. Objective 10 × 1 = 10 Mark, Q2. Short answer type - 5×4 = 20 Marks** **Section B : Descriptive answer type qts., 1 out of 2 from each unit - 4×10 = 40 Marks**		

Name and Signature of Convener and Members of CBoS

Dr. Arvind Agrawal

15/7/25

Dr. Nelson Xess

Neetu (Wasule) Das

Part – A: Introduction			
Program:Master In Microbiology		Smemester - III	Session: 2024-25
1	Course Code	MBSE-18T	
2	Course Title	Advanced Biotechniques	
3	Course Type	Discipline Specific Elective (DSE)	
4	Prerequisite (If Any)	As per Program	
5	Course Lerning Outcome (CLO)	At the end of this course, student will be able to ➢ Demonstrate an in-depth understanding of advanced microscopy and imaging techniques. ➢ Apply modern molecular biology methods in microbial research. ➢ Perform advanced protein analysis using proteomics tools. ➢ Operate and interpret results from analytical and bioinformatics tools. ➢ Integrate multidisciplinary techniques for problem-solving in microbiological research. ➢ Critically assess and present experimental data with accuracy and ethical responsibility.	
6	Credit Value	03 Credits	Credit = 15 Hours – Learning and Observation
7	Total Marks	Max. Marks: 100	Minimum Pass marks – 40

PART B: CONTENT OF THE COURSE

Total No. of Teaching/Learning Periods: (01 hr. per period) – 45 period (45 Hours)

Unit	TOPIC (Course Contents)	No. of Periods
I	**Advanced Microscopy and Imaging Techniques** : Principles, working method and applications of Confocal Laser Scanning Microscopy (CLSM), Atomic Force Microscopy (AFM), Scanning Electron Microscopy (SEM), Transmission Electron Microscopy (TEM), Fluorescence Microscopy and Live-cell Imaging, Digital Image Analysis and 3D Reconstruction. Cryo-electron microscopy: basic introduction and applications in virology and structural microbiology, Super-resolution microscopy (e.g., STED, SIM, PALM).	10
II	**Advanced Molecular Biology Techniques:** Real-Time PCR (qPCR) and Digital Droplet PCR (ddPCR), Microarray technology: gene expression profiling, Next-Generation Sequencing (NGS): platforms, workflow, and applications, CRISPR-Cas systems: genome editing and microbial strain engineering, Transcriptomics and RNA-Seq, Molecular cloning using Gibson Assembly, Golden Gate cloning, Single-cell genomics, CRISPRa and CRISPRi techniques.	12
III	**Proteomics and Protein Analysis**: Protein quantification techniques: Bradford, BCA, Lowry, 2D-PAGE and Difference Gel Electrophoresis (DIGE), Mass Spectrometry (MALDI-TOF, ESI-MS): Principle and Applications, Western blotting and Immunodetection methods (ELISA, Luminex, AlphaLISA), Protein-protein interaction analysis: Co-IP, Yeast Two-Hybrid, BiFC, Introduction to Structural Biology Tools: X-ray crystallography and NMR. Label-free proteomics, Use of AI-based tools like AlphaFold in structural prediction.	11
IV	**Analytical and Bioinformatics Tools:** Flow Cytometry and Cell Sorting (FACS), Biosensors and Lab-on-a-Chip devices, Surface Plasmon Resonance (SPR) and Isothermal Titration Calorimetry (ITC), Spectroscopic techniques: UV-Vis, Fluorescence, Circular Dichroism, Bioinformatics tools for sequence analysis: BLAST, Clustal Omega, MEGA, AI/ML applications in data analysis, Use of platforms like Galaxy, Geneious, and Bioconductor for microbiological datasets, Omics integration: Metagenomics, Metabolomics, and Systems Biology overview	12
keyword	**Super-resolution microscopy, CRISPRa and CRISPRi, Two-Hybrid, Metabolomics**	

Name and Signature of Convener and Members of CBoS

Dr. Arvind Agrawal

15/7/25 Neetu (Nitasha) Das

Dr. Nelson Xess

Part – C : Learning Resources

Text Books, Reference Books and Others

Text Book Recommended :

1. **Molecular Cloning: A Laboratory Manual by *Authors*: Michael R. Green, Joseph Sambrook**
2. **Principles and Techniques of Biochemistry and Molecular Biology by Keith Wilson, John Walker**
3. **roteomics: From Protein Sequence to Function by S.R. Pennington, M.J. Dunn**
4. **Bioinformatics: A Practical Guide to the Analysis of Genes and Proteins by Andreas D. Baxevanis, B.F. Francis Ouellette**

Reference Books :

1. **Advanced Fluorescence Microscopy – P. Michael Conn**
2. **Protein-Protein Interactions: A Molecular Cloning Manual– Erica A. Golemis**
3. **Introduction to Proteomics: Principles and Applications – Nawin C. Mishra**

Online Resources – e-Resources/e-Books and e-learning portals

1. https://www.ncbi.nlm.nih.gov/
2. https://www.ebi.ac.uk/training/
3. https://usegalaxy.org/
4. https://www.addgene.org/protocols/
5. https://www.edx.org/
6. https://www.coursera.org/specializations/genomic-data-science

Part – D : Assessment and Evaluation

Suggested Continuous Evaluation Methods :
Maximum Marks : 100 Marks
Continuous Internal Assessment : 30 Marks
End Semester Exam : 70 Marks

Continuous Internal Assessment (CIA): (By Course Teacher)	Internal Test/Quiz - **(2)** : Assignement/Seminar – Total Marks -	**20+20** **10** **30**	Better Marks out of the two Test/Quiz + Obtained marks in Assignment Shall be Considered against **30** marks
End Semester Exam (ESE) :	**Two Section – A & B** **Section A : Q1. Objective 10 × 1 = 10 Mark, Q2. Short answer type - 5×4 = 20 Marks** **Section B : Descriptive answer type qts., 1 out of 2 from each unit - 4×10 = 40 Marks**		

Name and Signature of Convener and Members of CBoS

Dr. Arvind Agarwal

Dr. Nelson Xess

Part – A: Introduction				
Program:Master In Microbiology		Smemester - III		Session: 2024-25
1	Course Code	MBSE-۸۹T		
2	Course Title	Microbial Genetic Engineering		
3	Course Type	Discipline Specific Elective (DSE)		
4	Prerequisite (If Any)	As per Program		
5	Course Lerning Outcome (CLO)	At the end of this course, student will be able to ➢ Explain the fundamental principles and tools of genetic engineering. ➢ Design and construct recombinant plasmids and microbial expression systems. ➢ Analyze and evaluate genome editing technologies in microbes. ➢ Critically assess the applications of engineered microbes in biotechnology and health. ➢ Interpret ethical, biosafety, and regulatory aspects of genetic engineering. ➢ Use bioinformatics tools for gene design and genetic modification.		
6	Credit Value	03 Credits	Credit = 15 Hours – Learning and Observation	
7	Total Marks	Max. Marks: 100	Minimum Pass marks – 40	

PART B: CONTENT OF THE COURSE

Total No. of Teaching/Learning Periods: (01 hr. per period) – 45 period (45 Hours)

Unit	TOPIC (Course Contents)	No. of Periods
I	**Fundamentals of Genetic Engineering**: Historical background and scope of genetic engineering, DNA manipulation enzymes: Restriction endonucleases, ligases, polymerases, nucleases, Cloning vectors: Plasmids, bacteriophages (λ), cosmids, BACs, YACs, Transformation techniques: $CaCl_2$ method, electroporation, liposome-mediated, biolistics, Selection and screening of recombinants: Blue-white screening, reporter genes, antibiotic resistance.	10
II	**Gene Cloning and Expression Systems:** Gene cloning strategies and construction of recombinant DNA, Expression vectors: prokaryotic (E. coli, Bacillus), eukaryotic (yeast, insect, mammalian), Inducible and constitutive promoters, fusion tags, Expression and purification of recombinant proteins, Site-directed mutagenesis and protein engineering, Codon optimization and expression in heterologous hosts.	12
III	**Genome Editing and Synthetic Biology**: CRISPR-Cas systems: Mechanism, design, and microbial applications, TALENs and Zinc-Finger Nucleases: Structure and function, Gene knock-out and knock-in strategies in microbes, Synthetic biology tools: Gene circuits, biosensors, minimal genomes, Regulatory elements in engineered microbes (riboswitches, synthetic promoters), Safety, bioethics, and containment strategies for GMOs.	11
IV	**Applications and Advanced Tools:** Metabolic engineering of microbes for industrial applications, Engineering microbial consortia and microbiomes, Recombinant vaccines and microbial production of therapeutics (e.g., insulin, antibiotics, enzymes), Use of omics technologies (genomics, transcriptomics, proteomics) in strain improvement, Systems biology approaches and metabolic flux analysis, Patent laws, biosafety levels, and guidelines (Cartagena Protocol, DBT regulations).	12
keyword	**Blue-white screening, Site-directed mutagenesis, TALENs, transcriptomics**	

Name and Signature of Convener and Members of CBoS

Dr. Arvind Agarwal
AA

15/7/25
Neetu (Masule) Das

Dr. Nelson Xess

Part – C : Learning Resources

Text Books, Reference Books and Others

Text Book Recommended :

1. **Molecular Biology of the Gene by James D. Watson, Tania Baker, Stephen P. Bell**
2. **Principles of Gene Manipulation and Genomics by Sandy B. Primrose, Richard Twyman**
3. **Molecular Biotechnology: Principles and Applications of Recombinant DNA by Bernard R. Glick, Cheryl L. Patten, Terry L. Delovitch**
4. **Synthetic Biology: Tools and Applications by Huimin Zhao**
5. **Genome Editing and Engineering: From TALENs, ZFNs to CRISPR by Krishnarao Appasani**

Reference Books :

1. **Genomes 4 – T.A. Brown**
2. **Gene Cloning and DNA Analysis – T.A. Brown**
3. **CRISPR-Cas: A Laboratory Manual – Jennifer A. Doudna, Prashant Mali**

Online Resources – e-Resources/e-Books and e-learning portals

1. https://www.addgene.org/
2. https://www.benchling.com/
3. http://sbolstandard.org/
4. https://www.addgene.org/protocols/
5. https://crisprtx.com/about-crispr/
6. https://www.ebi.ac.uk/

Part – D : Assessment and Evaluation

Suggested Continuous Evaluation Methods :
Maximum Marks : 100 Marks
Continuous Internal Assessment : 30 Marks
End Semester Exam : 70 Marks

Continuous Internal Assessment (CIA): (By Course Teacher)	Internal Test/Quiz - (2) : Assignement/Seminar – Total Marks -	**20+20** **10** **30**	Better Marks out of the two Test/Quiz + Obtained marks in Assignment Shall be Considered against **30** marks
End Semester Exam (ESE) :	**Two Section – A & B** **Section A : Q1. Objective 10 × 1 = 10 Mark, Q2. Short answer type - 5×4 = 20 Marks** **Section B : Descriptive answer type qts., 1 out of 2 from each unit - 4×10 = 40 Marks**		

Name and Signature of Convener and Members of CBoS

Dr. Arvind Agarwal

15/7/25

Dr. Nelson Xess

Part – A: Introduction			
Program:Master In Microbiology		Smemester - III	Session: 2024-25
1	Course Code	MBSE-20T	
2	Course Title	Advanced Microbiological Laboratory Techniques in Clinical and Research Applications	
3	Course Type	Discipline Specific Elective (DSE)	
4	Prerequisite (If Any)	As per Program	
5	Course Lerning Outcome (CLO)	At the end of this course, student will be able to ➢ Explain Clinical and Diagnostic Microbiology Techniques. ➢ Explain Molecular Microbiology and Genomic Tools. ➢ Utilize Immunological and Serological Techniques. ➢ Monitor microbial loads in clinical and environmental settings. ➢ Conduct cell culture and microscopy-based interaction studies.	
6	Credit Value	03 Credits	Credit = 15 Hours – Learning and Observation
7	Total Marks	Max. Marks: 100	Minimum Pass marks – 40

PART B: CONTENT OF THE COURSE

Total No. of Teaching/Learning Periods: (01 hr. per period) – 45 period (45 Hours)

Unit	TOPIC (Course Contents)	No. of Periods
I	**Clinical and Diagnostic Microbiology Techniques:** Automation in clinical microbiology (e.g., BD Phoenix, VITEK 2, MALDI-TOF MS), Blood and body fluid culture systems (BACTEC, BacT/ALERT), Advanced antimicrobial susceptibility testing (AST), MIC detection, E-test, Rapid diagnostic tests (RDTs) and point-of-care testing, NAATs (PCR, LAMP, multiplex PCR) in pathogen detection, Biosafety levels (BSL I–IV), lab safety practices, waste disposal.	10
II	**Molecular Microbiology and Genomic Tools:** Real-time PCR (qPCR), RT-PCR, digital PCR, Whole Genome Sequencing (WGS), NGS applications in microbiology, Metagenomics and microbiome analysis, CRISPR-based diagnostics (e.g., SHERLOCK, DETECTR), DNA/RNA extraction automation platforms, Bioinformatics tools in diagnostics (BLAST, GenBank, PathogenFinder).	12
III	**Immunological and Serological Techniques:** ELISA (direct, indirect, sandwich), CLIA, lateral flow immunoassays, Immunofluorescence assays and flow cytometry, Monoclonal antibody production and usage, Cytokine profiling and immune markers (Luminex, bead-based assays), Serodiagnosis of infectious diseases (e.g., dengue, HIV, hepatitis).	11
IV	**Environmental and Research Laboratory Applications:** Air, water, and surface microbial load monitoring in hospitals (swab test, settle plate method, air sampler), ATP bioluminescence assay for surface hygiene monitoring, Biosensor-based microbial detection (electrochemical, optical), Cell culture and microbial interaction assays, Confocal and fluorescence microscopy in microbiology research, Data documentation, GLP, and NABL accreditation essentials.	12
keyword	**Molecular diagnostics, CRISPR diagnostics, Biosensor-based detection, Microbial load monitoring**	

Name and Signature of Convener and Members of CBoS

Dr. Arvind Agrawal

15/7/25

Neetu (Nayak) Das

Dr. Nelson Xess

Part – C : Learning Resources			
Text Books, Reference Books and Others			
Text Book Recommended : 1. **Medical Microbiology by Murray, Rosenthal, Pfaller** 2. **Clinical Microbiology Made Ridiculously Simple by Mark Gladwin, William Trattler** 3. **Molecular Biotechnology: Principles and Applications of Recombinant DNA by Bernard R. Glick, Cheryl L. Patten, Terry L. Delovitch** 4. **Manual of Clinical Microbiology (American Society for Microbiology) by James Versalovic et al.** 5. **Genome Editing and Engineering: From TALENs, ZFNs to CRISPR by Krishnarao Appasani** **Reference Books :** 1. **Topley & Wilson's Microbiology and Microbial Infections – Stephen Gillespie, Kathleen Bamford** 2. **Advanced Techniques in Diagnostic Microbiology – Yi-Wei Tang, Charles W. Stratton** 3. **Manual of Molecular and Clinical Laboratory Immunology – Barbara Detrick, John L. Sullivan** 4. **Principles and Techniques of Biochemistry and Molecular Biology - Keith Wilson, John Walker**		
Online Resources – e-Resources/e-Books and e-learning portals 1. https://clsi.org/ 2. https://asm.org/Clinical 3. https://www.gisaid.org/ | https://www.ncbi.nlm.nih.gov/genbank/ 4. https://www.mg-rast.org/ 5. https://crisprtx.com/about-crispr/			
Part – D : Assessment and Evaluation			
Suggested Continuous Evaluation Methods : **Maximum Marks : 100 Marks** **Continuous Internal Assessment : 30 Marks** **End Semester Exam : 70 Marks**			
Continuous Internal Assessment (CIA): (By Course Teacher)	Internal Test/Quiz - **(2)** : Assignement/Seminar – Total Marks -	**20+20** **10** **30**	Better Marks out of the two Test/Quiz + Obtained marks in Assignment Shall be Considered against **30** marks
End Semester Exam (ESE) :	**Two Section – A & B** **Section A : Q1. Objective 10 × 1 = 10 Mark, Q2. Short answer type - 5×4 = 20 Marks** **Section B : Descriptive answer type qts., 1 out of 2 from each unit - 4×10 = 40 Marks**		

Name and Signature of Convener and Members of CBoS

Dr. Arvind Agrawal

15/7/25

Neetu (Navneet) Das

Dr. Nelson Xess

Part – A: Introduction			
Program:Master In Microbiology		Smemester - IV	Session: 2024-25
1	Course Code	MBS.C-108P	
2	Course Title	Dissertation / Research Project	
3	Course Type	Core (Research-Based)	
4	Prerequisite (If Any)	As per Program	
5	Course Lerning Outcome (CLO)	At the end of this course, student will be able to ➢ To develop independent research skills and scientific inquiry among students. ➢ To train students in experimental design, data collection, analysis, and interpretation. ➢ To promote critical thinking and problem-solving in real-world research contexts. ➢ To strengthen students' abilities in scientific writing, reporting, and communication. ➢ To inculcate ethical research practices, teamwork, and professional conduct.	
6	Credit Value	20 Credits	Credit = 15 Hours – Learning and Observation
7	Total Marks	Max. Marks: 600	Minimum Pass marks – 240

PART B: CONTENT OF THE COURSE

Total No. of Teaching/Learning Periods: 150 days

Unit	TOPIC (Course Contents)	No. of Periods
I	Synopsis Preparation & Plan of work	30
II	Research Work	120
III	Research Writing	120
IV	Reaearch Presentation through Viva- Voce	30

Name and Signature of Convener and Members of CBoS

Dr. Arvind Agrawal

15/7/25
Neetu (Nasule) Das

Dr. Nelson Xess

Part – C : Learning Resources

Text Books, Reference Books and Others

Text Book Recommended :

- Zar, J.H. – *Biostatistical Analysis*
- Norman & Streiner – *Biostatistics: The Bare Essentials*
- Rosner, B. – *Fundamentals of Biostatistics*

Reference Books :

- Kothari, C.R. – *Research Methodology: Methods and Techniques*
- Wayne Goddard & Stuart Melville – *Research Methodology: An Introduction*
- Robert V. Hogg & Johannes Ledolter – *Applied Statistics for Engineers and Physical Scientists*
- Day, R.A. & Gastel, B. – *How to Write and Publish a Scientific Paper*

Online Resources – e-Resources/e-Books and e-learning portals

- https://scholar.google.com
- https://pubmed.ncbi.nlm.nih.gov
- https://www.sciencedirect.com
- https://www.researchgate.net
- https://shodhganga.inflibnet.ac.in
- https://www.scopus.com
- https://link.springer.com

Part – D : Assessment and Evaluation

Suggested Continuous Evaluation Methods :
Maximum Marks : **600 Marks**
End Semester Exam : **600 Marks**

End Semester Exam (ESE) :	**Two Section – A & B** **Section A : Q1.Synopsis Preparation & Research Proposal : 100** **Q2. Experimental Work & Diligence = 200** Marks , **Q3. Final Dissertation Report – 200** Marks **Section B :** Presentation & Viva-Voce = **100 Marks**

Name and Signature of Convener and Members of CBoS

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TWO YEAR POSTGRADUATE PROGRAM

Department of Microbiology

Course Curriculum–2025-26

M.Sc. SEM III		Year: 2025	Session:2025-26
1	Course Code	MBSE-17 P, MBSE-18P & MBSE-19P	
2	Course Title	Research Methodology, Biostatistics & Advanced Biotechniques	
3	Course Type	Laboratory Course	
4	Prerequisite (IfAny)	As per Program	
5	Course Outcome (CLO)	At the end of this course student will be able to ➢ Develop a basic hypothesis and design an experimental research. ➢ Draft concise project proposals. ➢ Calculate and interpret central tendency. ➢ Create and interpret bar graphs and pie charts. ➢ Perform separation and analysis of DNA samples. ➢ Run Polymerase Chain Reaction (PCR)	
6	Credit Value	2 C	02 Credit = 30 Hrs. of Practical/ Field Work
7	Total Marks	Max. Marks :50	Minimum Pass marks – 20

PART B: CONTENT OF THE COURSE

Total No. of Teaching/Learning Periods:30Hours

Module	TOPIC (Course Contents)	No. of Periods
Lab./Field Training/Experiment contents of Course	1. Develop a basic hypothesis and design a corresponding experimental outline. 2. To Draft a short proposal for a microbiology project, including background, objectives, hypothesis, and expected outcomes. 3. To Collect recent research articles related to a chosen microbiology topic and summarize their key findings. 4. Demonstrate simple sampling methods (random, stratified) for collecting data from the environment. 5. Calculate Mean, Median, and Mode for given data. 6. Perform Basic Standard Deviation and Variance Calculations for given data. 7. Create and Interpret Bar Graphs and Pie Charts for given data. 8. To calculate Chi square and T test value for given data. 9. To Perform Basic Agarose Gel Electrophoresis for DNA Separation. 10. Demonstrate Polymerase Chain Reaction (PCR) Setup. 11. Simple Plasmid Isolation Using Alkaline Lysis Method. 12. Perform Paper/TLC chromatography for amino acid/plant extract. 13. Demontrate bacterial growth curve by using colorimeter/spectrophotometer.	30
Keyword	Research hypothesis, Deviation, Agarose Gel, PCR, TLC, Spectrophotometer	

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Dr. Nelson Xess

Neeta Wasule

PART:C

Learning Recourses:TextBooks,Reference Books and Others

TextBooksRecommended:

1. Laboratory manual of Microbiology and Biotechnology–K. R.Aneja
2. Practical Microbiology–R.C. DubeyandD.K.Maheshwari
3. Laboratory manual in Microbiology–P.Gunasekaran
4. Experimenti n Microbiology,Plant pathology and Biotechnology-K.R.Aneja

Online Recourses:

1. e_https://books.google.co.in/books?id=Wh9OTbjcsfUC&printsec=frontcover&source=gbs
2. https://microbiologysociety.org/static/uploaded/23cbf9c5-f8c8-4f91-b092a4ad819e6357.pdf
3. https://books.google.co.in/books?id=RLpEDWAAQBAJ&pg=PA46&source=gbs_toc_r&cad=2#v=onepage&q&f=false
4. ehttps://books.google.co.in/books?id=Wh9OTbiesfUC&printsec=age&a&false
5. ehttps://sist.sathyabama.ac.in/sist_coursematerial/uploads/SMB210L.pdf

PART D:Assessment And Evaluation

Suggested Continuous Evaluation Methods:
Maximum Marks: 50 Marks
Continuous Internal Assessment(CIA): 15Marks
End Semester Exam (ESE): 35 Marks

Continuous Internal Assessment (CIA): (By Course Teacher)	**Internal Test/Quiz - (2): 10 & 10** **Assignment/ Seminar + Attendance: 05** **Total marks: 15**	Better Marks out of twoTest/Quiz + Obtained marks in Assignment shall be considered against 15 marks
End Semester Exam (ESE):	**Laboratory /Field Skill Performance: On spot Assessment** **Perform the Task based on lab. Work – 20Marks** **Spotting based on tools and technology (written)– 10 Marks** **Viva-voce (based on principle/technology)- 05Marks**	**Managed by course teacher as per lab. status**

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Dr. Nelson Xess

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M.Sc. SEM III		Year:2025	Session:2025-26
1	Course Code	MBSE-20 P & MBSE-21P	
2	Course Title	Microbial Genetic Engineering and Advanced Microbial Laboratory Techniques in Clinical and Research Application	
3	Course Type	Laboratory Course	
4	Prerequisite(IfAny)	As per Program	
5	Course Outcome (CLO)	Attheend of this course, student will be able to ➢ Learn the technique of bacterial transformation ➢ Isolate plasmid DNA from transformed ➢ Select and Screen of recombinant bacterial colonies ➢ Interpret resistance patterns ➢ Measure various growth phases.	
6	Credit Value	2 C	02Credit = 30Hrs. of Practical/ FieldWork
7	Total Marks	Max.Marks:50	Minimum Pass marks – 20

PART B:CONTENT OF THE COURSE

Total No. of Teaching/Learning Periods:30Hours

Module	TOPIC (Course Contents)	No. of Periods
Lab./Field Training/Experiment contents of Course	1. Preparation of Competent *E. coli* Cells by Calcium Chloride Method. 2. Bacterial Transformation with Plasmid DNA (Heat Shock Method) 3. Plasmid DNA Isolation by Alkaline Lysis Method 4. Restriction Digestion of Isolated Plasmid DNA 5. Preparation of LB Agar Plates with Antibiotics for Screening Recombinant Clones 6. Antibiotic Susceptibility Testing by Kirby-Bauer Disc Diffusion Method 7. Gram Staining and Microscopic Observation of Clinical Isolates 8. Quantitative Estimation of Bacterial Growth Using Optical Density (OD600) Measurement 9. Blood Agar Preparation and Hemolysis Detection 10. Enzyme-Linked Immunosorbent Assay (ELISA) Demonstration	30
keyword	Antibiotic Susceptibility, Plasmid, Optical density, Hemolysis, ELISA	

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PART:C

Learning Recourses:TextBooks,Reference Books and Others

TextBooks Recommended:

1. Laboratory manual of Microbiology and Biotechnology–K. R.Aneja
2. Practical Microbiology–R.C. DubeyandD.K.Maheshwari
3. Laboratory manual in Microbiology–P.Gunasekaran
4. Experiment in Microbiology,Plant pathology and Biotechnology-K.R.Aneja
5. Experiments in Biotechnology-Nighojkar and Nighojkar
6. Current protocols in molecular biology-Ausbel
7. Bioinformatics- A Practical Guide to the Analysis of Genes and Proteins; Baxevanis, A.D. and Francis Quellellette, B.F., Wiley India Pvt Ltd. (2009).

Online Recourses:

1. https://iris.who.int/bitstream/handle/10665/337956/97892400113il-eng.pdf?sequence=1
2. e=https:/Avww.aphlore/programs/preparedness/Smallpox/ndf/the-1-2-3s-of-biosafety-levels.pdf
3. e=https:/Avww.wino.int/edocs/pubdocs/enAntproperty/932/Avipopubb932ipb.pdf
4. e=https:/Avww.annauniv.edu/ipr/files/downloadable/Overview200f%201IPRpdf
5. e bttps://webstor.srmist.edu.in/web_assets/srm_mainsite/files/files/BIQS05°220LAB%20MANUAL pdt
6. ehttps:/Avww.polvgewalior.ac.in/file/20181204071417842813ndf
7. ehttps://books.google.co.in/books?id=Wh9OTbijesfUCeevintoene=age&q&f=false

PART D:Assessment And Evaluation

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