MGM University

Vision

- To ensure sustainable human development which encourages self-reliant and self-content society.
- To promote activities related to community services, social welfare and also Indian heritage and culture.
- To inculcate the culture of non-violence and truthfulness through vipassanna meditation and Gandhian Philosophy.
- To develop the culture of simple living and high thinking

Mission

- To impart state of art education and technical expertise to students and give necessary training to teachers to create self-reliant society for future.
- To encourage students to participate in Indian and International activities in sports, literature, etc. so that future generation becomes base for free and liberal society
- To educate students in areas like Management, Finance, Human relations to inculcate philosophy of simple living and high thinking value of simple economic society.
- To inculcate culture of non-violence and truthfulness through Vipassana.

  To sustain activities of Indian culture (viz. classical dance, music and fine arts) through establishing institutes like Mahagami, Naturopathy, etc.

विद्यापीठ गीत

अत्त दिप भव भव प्रदिप भव,

स्वरूप रूप भव हो

ज्ञान सब्ब विज्ञान सब्ब भव ,

सब्ब दिप भव हो

अत्ताहि अत्त नो नाथो ,

अत्ताहि अत्त नो गति

अत्त मार्गपर अप्रमादसे है तुझे चलना

सब्ब का कल्याण हो ,

वो कार्यकुशल करना

सब्ब का उत्तम मंगल , पथप्रदर्शक हो

अत्त दिप भव भव प्रदिप भव ,

स्वरूप रूप भव हो

ज्ञान सब्ब विज्ञान सब्ब भव ,

सब्ब दिप भव हो

बुद्धमं शरनं गच्छामि :

धम्मं शरनं गच्छामि :

संघं शरनं गच्छामि :

INSTITUTE OF BIOSCIENCES AND TECHNOLOGY

We are contributor in Medical and Advances in Agriculture sciences by studying living systems and organisms for development and research purpose. We shape our student for their bright future in thin field by proving knowledge and best practical facilities.

The Mahatma Gandhi Mission's Institute of Biosciences and Technology is promoted by Mahatma Gandhi Mission (MGM) Trust. The Mahatma Gandhi Mission Trust was founded with a vision to address the educational, health and other social needs of the public since 1983. MGM visualized the density of the field of life science resources and possible careers which will be helpful in the area of research. Through this keen interest MGM established the department of Biotechnology and Bioinformatics in 2001-2002.

Then in the year 2002-2003, with the affiliation of Dr. Babasaheb Ambedkar Marathwada University, the course of M.Sc. Biotechnology was started – a very large ambition and a great milestone in the area of Biotechnology. In the year 2004-05 MGM's IBT launched a course of B.Sc. Agricultural Biotechnology under the affiliation of Marathwada Krishi Vidyapeeth, Parbhani. With the launch of this course the department of biotechnology and Bioinformatics became the crowning glories of Marathwada region.

A tiny seedling turned into a huge tree with multiple branches. In the year 2005-2006 MGM's IBT visualized the importance informatics. Consistent with the attitude to excel in the field of biotechnology, the course of M.Sc. Bioinformatics was launched under the affiliation of Dr. Babasaheb Ambedkar Marathwada University, Aurangabad, in 2005-2006.

Now MGM's IBT is well established in the field of research focusing on the areas of Biotechnology and Bioinformatics with well-equipped R&D laboratory encouraging and supporting extensive research.

Vision

"To achieve academic excellence through research, teaching and training in biosciences disciplines which will eventually serve and benefits the society"

Mission

- To generate necessary and intellectually qualified biological work force.
- Strive to provide services and solutions through biologic knowledge forecasting the welfare and benefit of the society

Programs offered at IBT

Undergraduate Programmes	Postgraduate Programmes	PhD Programmes	PG Diploma Programmes	Certificate Programmes
B.Sc. Biotechnology Honours / Honours with Research	M.Sc. Biotechnology	Ph.D. Biotechnology		
B.Sc. Microbiology Honours/ Honours with Research	M.Sc.Microbiology/ Virology	Ph.D. Microbiology		
B.Sc. Bioinformatics Honours / Honours with Research	M.Sc. Bioinformatics	Ph.D. Bioinformatics		
B.Sc. Food Technology and Processing Honours / Honours with Research	M.Sc. Food Technology	Ph.D.Food Technology & Processing		
B.Sc. Food nutrition and Ditetics Honours / Honours with Research	M.Sc. Plant Breeding and Molecular Genetics	Ph.D.Plant Breeding & Molecular Genetics		
B. Tech. Biomedical Engineering		Ph.D. Plant Biotechnology		
B. Tech. Biotechnology				
B. Tech. Food Processing and Technology				

Department of Microbiology

The Bachelor of Science (B. Sc.) in Microbiology degree program started in the year 2020 and is approved by the University Grant Commission (UGC), New Delhi and offers Choice Based Credit System education. In addition to core courses, students can opt for discipline specific elective subjects, open elective subjects from different institutes of the University. In addition, this program is uniquely designed to increase the employability and to prepare students to work in a Multi-disciplinary work environment. The program offers Major degree in Microbiology and is open to students opting for minor specializations as per their interests. Pedagogies concentrating on student's active participation are extensively used in the teaching-learning process.

Name of Program – B. Sc. (Hons) Microbiology

Duration – Four Years

Eligibility –

1. Maharashtra State Candidate.

(i) The Candidate should be an Indian National and having domicile of Maharashtra state and/or born in Maharashtra state.

(ii) Passed HSC or its equivalent examination with Physics and Mathematics as compulsory subjects along with one of the Chemistry or Biotechnology or Biology or Technical Vocational subject or Computer Science or Information Technology or Informatics Practices or Agriculture or Engineering Graphics or Business Studies, and obtained at least 45% marks (at least 40% marks, in case of Backward class categories and Persons with Disability candidates belonging to Maharashtra State only) in the above subjects taken together and the candidate should have appeared in MGMU-CET / MHT-CET / PERA CET / JEE (Main) Paper-I and should obtain non zero score in MGMU-CET / MHT-CET / PERA CET / JEE (Main) Paper-I. However, preference shall be given to the candidate obtaining non-zero positive score in MGMU-CET over the candidates who obtained non-zero score in MHT-CET / PERA CET.

2. All India Candidates –

(i) The Candidate should be an Indian National.

(ii) Passed HSC or its equivalent examination with Physics and Mathematics as compulsory subjects along with one of the Chemistry or Biotechnology or Biology or Technical Vocational subject or Computer Science or Information Technology or Informatics Practices or Agriculture or Engineering Graphics or Business Studies , and obtained at least 45% marks (at least 40% marks, in case of Backward class categories and Persons with Disability candidates belonging to Maharashtra State only) in the above subjects taken together and candidate should have appeared in MGMU-CET / MHT-CET / PERA CET/ JEE (Main) Paper-I and should obtain non-zero score in MGMU-CET/ MHT-CET / PERA CET / JEE (Main) Paper-I. However, preference shall be given to the candidate obtaining non-zero positive score in JEE Mains Paper-I over the candidates who obtained non-zero score in MGMU-CET / MHT-CET / PERA CET .

Name of Faculty: Basic and Applied SciencesGraduate (UG) Program
Name of the College/Institute/Department/School: Institute of Bioscience and Technology
Name of the Programme: B.Sc. (Hons) Microbiology
Programme Type (UG/PG): **UG/** B.Sc./B.Sc. Hons./B.Sc. Hons with Research of Microbiology
Duration: 04 Years (08 Semesters)

First Year- Semester I												
Course Category	**Course Code**	**Course Title**	**Nature of Course**	**No. of Credits**	**Teaching (Contact hrs/ week)**		**Evaluation Scheme (Marks)**			**Minimum Passing (Marks)**		
					L	**P**	**Internal**	**External**	**Total**	**Internal**	**External**	**Total**
MM	MIC42ML103	Microbial Physiology and Metabolism	Lecture	2	2		30	20	50	-	08	20
MM	MIC42ML104	Biology: Concept, Connections, Investigation and applications	Lecture	3	3	-	60	40	100	-	16	40
MI		Minor Course	Lecture	2	2	-	30	20	50	-	08	20
AEC	MGM54AEL101	Communicative English	Lecture	2	2	-	30	20	50	-	08	20
OE**		Open Elective I	Lecture	2	2	-	30	20	50	-	08	20
OE		Open Elective II	Lecture	2	2	-	30	20	50	-	08	20
VEC*	MGM21VEL102	Universal Human Values	Lecture	2	2	-	30	20	50	-	08	20
VSC*	MIC42VSP102	Micro Lab II	Practical	2		4	30	20	50	-	08	20
SEC*	MIC42SEP102	Explorations in Microbiology – I	Practical	2		4	30	20	50	-	08	20
MM	MIC42MMP102	Bio-Skills Sets Laboratory-I	Practical	1	-	2	30	20	50	-	08	20
CC	MGM82CCP103	Sports	Practical	2	-	4	30	20	50	-	08	20
Total				**22**	**15**	**14**	360	240	600	-	96	240

Note:
Nature of Course : L- Lecture, P-Practical, S-Seminar, J-Project, I-Internship, D-Dissertation,
Course Category: MM-Major Mandatory, ME-Major Elective, MI-Minor, OE-Generic / Open electives, VSC-Vocational skill course, SEC-Skill Enhancement course, AEC-Ability Enhancement course, IKS-Indian Knowledge system, VEC-Value Education course, OJT-On Job Training / Internship / Apprenticeship, FP-Field project, CEP-Community engagement and service, CC-Co – curricular course, RM-Research methodology, RP-Research project

First Year- Semester II												
Course Category	**Course Code**	**Course Title**	**Nature of Course**	**No. of Credits**	**Teaching (Contact hrs/ week)**		**Evaluation Scheme (Marks)**			**Minimum Passing (Marks)**		
					L	**P**	**Internal**	**External**	**Total**	**Internal**	**External**	**Total**
MM	MIC42MML103	Microbial Physiology and Metabolism	Lecture	2	2		30	20	50		08	20
MM	MIC42MML104	Biology: Concept, Connections, Investigation and applications	Lecture	3	3	-	60	40	100		16	40
MI		Minor Course	Lecture	2	2	-	30	20	50		08	20
AEC	MGM54AEL101	Communicative English	Lecture	2	2	-	30	20	50		08	20
OE**		Open Elective I	Lecture	2	2	-	30	20	50		08	20
OE		Open Elective II	Lecture	2	2	-	30	20	50		08	20
VEC*	MGM21VEL102	Universal Human Values	Lecture	2	2	-	30	20	50		08	20
VSC*	MIC42VSP102	Micro Lab II	Practical	2		4	30	20	50		08	20
SEC*	MIC42SEP102	Explorations in Microbiology –I	Practical	2		4	30	20	50		08	20
MM	MIC42MMP102	Bio-Skills Sets Laboratory-I	Practical	1	-	2	30	20	50		08	20
CC	MGM82CCP103	Sports	Practical	2	-	4	30	20	50		08	20
Total				**22**	**15**	**14**	360	240	600	-	96	240

Note:
Nature of Course : L- Lecture, P-Practical, S-Seminar, J-Project, I-Internship, D-Dissertation,

Course Category: MM-Major Mandatory, ME-Major Elective, MI-Minor, OE-Generic / Open electives, VSC-Vocational skill course, SEC-Skill Enhancement course, AEC-Ability Enhancement course, IKS-Indian Knowledge system, VEC-Value Education course, OJT-On Job Training / Internship / Apprenticeship, FP-Field project, CEP-Community engagement and service, CC-Co – curricular course, RM-Research methodology, RP-Research project

Level 4.5 Award of UG certificate with 40 credits and an additional 4-credits core NSQF course / internship OR continue with major and minor

Second Year- Semester III												
Course Category	**Course Code**	**Course Title**	**Nature of Course**	**No. of Credits**	**Teaching (Contact Hrs/ week)**		**Evaluation Scheme (Marks)**			**Minimum Passing (Marks)**		
					L	**P**	**Internal**	**External**	**Total**	**Internal**	**External**	**Total**
MM	MIC42MML201	Molecular Biology of Gene	Lecture	2	2	-	30	20	50	-	08	20
MM	MIC42MML202	Virology	Lecture	3	3	-	60	40	100	-	16	40
MM	MIC42MML203	Microbial Fermentation	Lecture	2	2	-	30	20	50	-	08	20
OE		**Open Elective V**	Lecture	2	2	-	30	20	50	-	08	20
MI		Minor Course	Lecture	3	3	-	60	40	100	-	16	40
AEC	**MGM54AEL103**	**Functional Hindi**	Lecture	2	2	-	30	20	50	-	08	20
VSC	MIC42VSP201	Applied MI Lab	Practical	2	-	4	30	20	50	-	08	20
MI		Minor Course	Practical	1	-	2	30	20	50	-	08	20
MM	MIC42MMP201	Fermentation Technology Laboratory	Practical	1	-	2	30	20	50	-	08	20
FP	MIC42FPJ201	Field Project	Project	2	-	4	30	20	50	-	08	20
CC	**MGM82CCP201**	**Health and Wellness**	Practical	2	-	4	30	20	50	-	08	20
Total				22	14	16	390	260	650	-	104	260

Note:

Nature of Course : L- Lecture, P-Practical, S-Seminar, J-Project, I-Internship, D-Dissertation,

Course Category: MM-Major Mandatory, ME-Major Elective, MI-Minor, OE-Generic / Open electives, VSC-Vocational skill course, SEC-Skill Enhancement course, AEC-Ability Enhancement course, IKS-Indian Knowledge system, VEC-Value Education course, OJT-On Job Training / Internship / Apprenticeship, FP-Field project, CEP-Community engagement and service, CC-Co – curricular course, RM-Research methodology, RP-Research project

Level 4.5 Award of UG certificate with 40 credits and an additional 4-credits core NSQF course / internship OR continue with major and minor

Second Year- Semester IV													
Course Category	**Course Code**	**Course Title**	**Nature of Course**	**No. of Credits**	**Teaching (Contact Hrs/ week)**		**Evaluation Scheme (Marks)**			**Minimum Passing (Marks)**		
					L	**P**	**Internal**	**External**	**Total**	**Internal**	**External**	**Total**
MM	MIC42MML 204	Genome Maintenance and Regulation	Lecture	2	2	-	30	20	50	-	08	20
MM	MIC42MML 205	Advance Fermentation Technology	Lecture	3	3	-	60	40	100	-	16	40
MM	MIC42MML 206	Molecular Basis of Bacterial Infection	Lecture	2	2	-	30	20	50	-	08	20
OE		**Open Elective VI**	Lecture	2	2	-	30	20	50	-	08	20
MI		Annexture I	Lecture	3	3	-	60	40	100	-	16	40
AEC	MGM54AEL 203	Communication skills	Lecture	2	2	-	30	20	50	-	08	20
SEC	MIC42SEP201	Infection control Lab	Practical	2		4	30	20	50	-	08	20
MI		Minor Course	Practical	1	-	2	30	20	50	-	08	20
MM	MIC42MMP 202	Advance Fermentation Laboratory	Practical	1	-	2	30	20	50	-	08	20
CEP	MIC42CEJ201	Community Engagement and Service (Field project)	Project	2	-	4	30	20	50	-	08	20
CC	MGM73CCP 105	**Fine Arts**	Practical	2		4	30	20	50	-	08	20
Total 30				**22**	**14**	**16**	390	260	650	-	104	260

Note:

Nature of Course : L- Lecture, P-Practical, S-Seminar, J-Project, I-Internship, D-Dissertation,

Course Category: MM-Major Mandatory, ME-Major Elective, MI-Minor, OE-Generic / Open electives, VSC-Vocational skill course, SEC-Skill Enhancement course, AEC-Ability Enhancement course, IKS-Indian Knowledge system, VEC-Value Education course, OJT-On Job Training / Internship / Apprenticeship, FP-Field project, CEP-Community engagement and service, CC-Co – curricular course, RM-Research methodology, RP-Research project

Third Year- Semester V												
Course Category	**Course Code**	**Course Title**	**Nature of Course**	**No. of Credits**	**Teaching (Contact hrs/ week)**		**Evaluation Scheme (Marks)**			**Minimum Passing (Marks)**		
					L	**P**	**Internal**	**External**	**Total**	**Internal**	**External**	**Total**
MM	MIC42MML301	Soil and Environment Microbial Biotechnology	Theory	2	2	-	30	20	50	-	08	20
MM	MIC42MML302	Wine and Brewing Microbiology	Theory	3	3	-	60	40	100	-	16	40
MM	MIC42MML303	Molecular Microbiology	Theory	2	2	-	30	20	50	-	08	20
ME	MIC42MEL201	Microbial Mechanisms of Foodborne disease	Theory	3	3	-	60	40	100	-	16	40
MI		Minor Course	Theory	3	3	-	60	40	100	-	16	40
VSC	MIC42VSL301	Python Lab	Practical	2		4	30	20	50	-	08	20
VSC	MIC42VSP301	Mini Project	Practical	2		4	30	20	50	-	08	20
MI		Minor Course	Practical	1	-	2	30	20	50	-	08	20
MM	MIC42MMP301	Microbial Analysis and use Laboratory	Practical	1	-	2	30	20	50	-	08	20
FP	MIC42FPJ301	Field Project	Practical	2		4	30	20	50	-	08	20
ME	MIC42MEP201	Seminar (Research Paper based)	Practical	1	-	2	30	20	50	-	08	20
Total				**22**	**13**	**18**	420	280	**700**	-	112	280

Note:

Nature of Course : L- Lecture, P-Practical, S-Seminar, J-Project, I-Internship, D-Dissertation,

Course Category: MM-Major Mandatory, ME-Major Elective, MI-Minor, OE-Generic / Open electives, VSC-Vocational skill course, SEC-Skill Enhancement course, AEC-Ability Enhancement course, IKS-Indian Knowledge system, VEC-Value Education course, OJT-On Job Training / Internship / Apprenticeship, FP-Field project, CEP-Community engagement and service, CC-Co – curricular course, RM-Research methodology, RP-Research project

Third Year- Semester VI													
Course Category	**Course Code**	**Course Title**	**Nature of Course**	**No. of Credits**	**Teaching (Contact hrs/ week)**		**Evaluation Scheme (Marks)**			**Minimum Passing (Marks)**		
					L	**P**	**Internal**	**External**	**Total**	**Internal**	**External**	**Total**
MM	MIC42MML304	Symbiosis, Plant Immunity and Disease	Lecture	2	2	-	30	20	50	-	08	20
MM	MIC42MML305	Industrial Microbiology	Lecture	3	3	-	60	40	100	-	16	40
MM	MIC42MML306	Gene Editing Technologies for Microbiology & therapeutic	Lecture	3	3	-	60	40	100	-	16	40
ME	MIC42MEL202	Mycology	Lecture	3	3	-	60	40	100	-	16	40
MI		Minor Course	Lecture	3	3	-	60	40	100	-	16	40
OJT	MIC42JTP301	On Job Training	Practical	4		8	60	40	100	-	16	40
MI		Minor Course	Practical	1		2	30	20	50	-	08	20
MM	MIC42MMP302	Diagnosis and Industrial Microbiology Lab.	Practical	1	-	2	30	20	50	-	08	20
MM	MIC42MMP303	Mini project	Practical	1	-	2	30	20	50	-	08	20
ME	MIC42MEP202	Data analysis and statistics	Practical	1	-	2	30	20	50	-	08	20
Total				**22**	**14**	**16**	450	300	**750**	-	120	300

Note:

Nature of Course : L- Lecture, P-Practical, S-Seminar, J-Project, I-Internship, D-Dissertation,

Course Category: MM-Major Mandatory, ME-Major Elective, MI-Minor, OE-Generic / Open electives, VSC-Vocational skill course, SEC-Skill Enhancement course, AEC-Ability Enhancement course, IKS-Indian Knowledge system, VEC-Value Education course, OJT-On Job Training / Internship / Apprenticeship, FP-Field project, CEP-Community engagement and service, CC-Co – curricular course, RM-Research methodology, RP-Research project

Level 5.5 Award of UG degree in major and minor (44+44+44)=132 credits OR continue with major and minor

Fourth Year- Semester VII												
Course Category	**Course Code**	**Course Title**	**Nature of Course**	**No. of Credits**	**Teaching (Contact hrs/ week)**		**Evaluation Scheme (Marks)**			**Minimum Passing (Marks)**		
					L	**P**	**Internal**	**External**	**Total**	**Internal**	**External**	**Total**
MM	MIC42MML 401	Biofertilizers	Lecture	3	3	-	60	40	100	-	16	40
MM	MIC42MML 402	Analysis of gene expression	Lecture	3	3	-	60	40	100	-	16	40
MM	MIC42MML 403	Microbiome	Lecture	3	3	-	60	40	100	-	16	40
MM	MIC42MML 404	Biosafety, IPR and Bioethics	Lecture	2	2	-	60	20	50	-	08	20
ME	MIC42MEL3 01	Bio-Protection	Lecture	3	3	-	60	40	100	-	16	40
RM	MIC42RML4 01	Research Methodology I	Lecture	3	3	-	60	40	100	-	16	40
RM	MIC42RMP4 01	Research Methodology II	Practical	1	-	2	30	20	50	-	08	20
ME	MIC42MEP3 01	R Programming	Practical	1	-	2	30	20	50	-	08	20
MM	MIC42MMP 401	Microbial Engineering Laboratory	Practical	1	-	2	30	20	50	-	08	20
MM	MIC42MMP 402	Major Project	Practical	1	-	2	30	20	50	-	08	20
MM	MIC42MMP 403	Bioferilizer lab	Practical	1	-	2	30	20	50	-	08	20
		Total=27		22	17	**10**	510	320	**800**	-	128	320

Note:

Nature of Course : L- Lecture, P-Practical, S-Seminar, J-Project, I-Internship, D-Dissertation,

Course Category: MM-Major Mandatory, ME-Major Elective, MI-Minor, OE-Generic / Open electives, VSC-Vocational skill course, SEC-Skill Enhancement course, AEC-Ability Enhancement course, IKS-Indian Knowledge system, VEC-Value Education course, OJT-On Job Training / Internship / Apprenticeship, FP-Field project, CEP-Community engagement and service, CC-Co – curricular course, RM-Research methodology, RP-Research project

Fourth Year- Semester VIII												
Course Category	**Course Code**	**Course Title**	**Nature of Course**	**No. of Credits**	**Teaching (Contact hrs/ week)**		**Evaluation Scheme (Marks)**			**Minimum Passing (Marks)**		
					L	**P**	**Internal**	**External**	**Total**	**Internal**	**External**	**Total**
MM	MIC42MML 405	Systems Microbiology	Lecture	3	3	-	60	40	100	-	16	40
MM	MIC42MML 406	Bacterial Genetics	Lecture	3	3	-	60	40	100	-	16	40
MM	MIC42MML 407	Cosmetic Microbiology	Lecture	3	3	-	60	40	100	-	16	40
MM	MIC42MML 408	Entrepreneurship microbiology	Lecture	2	2	-	30	20	50	-	08	20
ME	MIC42MEL302	Microbial quality control	Lecture	3	3	-	60	40	100	-	16	40
OJT	MIC42JTP401	On Job Training	Training	4		8	60	40	100	-	16	40
ME	MIC42MEP 302	Microbial quality control lab	Practical	1	-	2	30	20	50	-	08	20
MM	MIC42MMP 404	Practical Based on Research Methodology	Practical	1	-	2	30	20	50	-	08	20
MM	MIC42MMP 405	Big Idea	Practical	1	-	2	30	20	50	-	08	20
MM	MIC42MMP 406	Cosmetic microbiology lab	Practical	1	-	2	30	20	50	-	08	20
		Total=30		**22**	14	**16**	450	300	**750**	-	120	300

Note:

Nature of Course : L- Lecture, P-Practical, S-Seminar, J-Project, I-Internship, D-Dissertation,

Course Category: MM-Major Mandatory, ME-Major Elective, MI-Minor, OE-Generic / Open electives, VSC-Vocational skill course, SEC-Skill Enhancement course, AEC-Ability Enhancement course, IKS-Indian Knowledge system, VEC-Value Education course, OJT-On Job Training / Internship / Apprenticeship, FP-Field project, CEP-Community engagement and service, CC-Co – curricular course, RM-Research methodology, RP-Research project

Level 6.0 Four year UG Honours Degree in major and minor (44+44+44+44) = 176 credits

Syllabus

Semester-III

Course code: MIC42MML201 **Course name:** Molecular biology of gene **Course category:** Major Mandatory
Credits: 02 Teaching scheme: L-2 **Evaluation scheme:** CA–30, ESE–20
Exam Duration: 01 Hr
Pre-requisites: The student should have basic knowledge of biological and applied sciences, and successfully completed the first year of the Degree Program.
Course Objectives:
1. The objective of this course to provide knowledge of molecular Structure of genetic material, concept of gene and Genetic code
2. To learn the mechanism involved in expression of Genetic Material
3. To learn about DNA as genetic material their mode replication and function,
4. To learn about RNA and the molecular events that govern cell functions
5. To aware of the role and significance of gene, gene regulation and expression.
Course Outcomes: At the end of the course, the students will be able to -
CO1: The students will be able to learn and understand the current concepts in modern molecular genetics, and how to apply these techniques.
CO2: Students will understand the world of DNA and its functional relationship with its replication and they are able to describe Molecular Mechanism involved in the expression of Genetic Information.
CO3: Student will able to elucidate central cell biological processes and how they are regulated (for example: replication and protein synthesis and gene expression).
CO4: Student will able to learn DNA databases for data storage
CO5: Students will able to understand how molecular cell biology forms the foundation of biotechnology.

Contents –

Unit	Content	Teaching hours
1	**Building block of Nucleic Acids & Introduction to genetics** Structure and functions of Nucleic acids: Nucleosides & Nucleotides, purines and pyrimidines. Gene and Gene function: one gene/one enzyme hypothesis. Genome organization: Genome organization in prokaryotes and eukaryotes special features of eukaryotic gene structure and	7

	organization, genome organization in mitochondria and chloroplast.	
2	**DNA Replication and Mutation.** Features of DNA Replication, Proof of semi conservative nature of DNA replication, Features of bidirectional DNA replication. Mechanism of bidirectional DNA replication. Replication of bacteriophages. Mutations; base substitution, deletion and insertion.	7
3	**Gene expression and regulation** Gene as a unit of function. Transcription (prokaryotic and eukaryotic) – RNA polymerase, DNA sequences, transcription factors, process of initiation, elongation and termination. Post transcriptional modifications – capping, poly-adenylation, splicing (cis- and trans-), editing. Translation – genetic code, ribosome structure, the process of translation. Lac, trp and ara operons.	8
4	**Introduction to genomics and databases.** Introduction: Genome, Genomics and importance, General features, C-value paradox. Gene identification and regulation role of genetic analysis in understanding gene function and regulation; gene prediction rules , Genome databases; Annotation of genome. Genome diversity: taxonomy and significance of genomes – bacteria, yeast, Homosapiens, Arabidopsis	8

Text Books:
1. Primrose, S. B., and R. M. Twyman 2002)Principles of gene manipulation and Genomics.
2. Molecular Biology of the Cell" by Bruce Alberts, et al. (Edition: 6th, Year: 2014)
3. Lehninger Principles of Biochemistry" by David L. Nelson and Michael M. Cox (Edition: 7th, Year: 2017)
4. Molecular Biology" by Robert F. Weaver (Edition: 6th, Year: 2015)
5. Essential Cell Biology" by Bruce Alberts, et al. (Edition: 4th, Year: 2013)
Reference Books:
1. Brown T. A: 2017 Genomes Garland Science Publishing, New York.
2.Genes XI" by Benjamin Lewin (Edition: 11th, Year: 2013)
3. Hartwell, L. H., Goldberg, M. L., Fischer, J. A., & Hood, L. (2017). Genetics: From Genes to Genomes (6th ed.). Boston, MA: McGraw-Hill.
4. Alberts, B., Johnson, A., Lewis, J., Raff, M., Roberts, K., & Walter, P. (2014). Molecular Biology of the Cell (6th ed.). New York, NY: Garland Science.
5 Nelson, D. L., & Cox, M. M. (2017). Lehninger Principles of Biochemistry (7th ed.). New York, NY: W. H. Freeman.
Online Resources: 1. NPTEL / SWAYAM lectures.

Course code: MIC42MML202 Course name: Virology **Course category:** Major Mandatory
Credits: 3 **Teaching scheme:** L-3 **Evaluation scheme:** CA–60, ESE–40
Exam Duration: 02 Hrs
Pre-requisites: The student should have basic knowledge of biological and applied sciences, and successfully completed the first year of the Degree Program.

Course Objectives:
1.The coarse aim to provide basic and advanced level understanding of the viruses and function of the immune system and spread
2.Students will aware the distinctive characteristics of viruses and the biological, chemical and physical properties of viruses ,
3.To describe at the molecular level of the replication strategies of representative of DNA and RNA viruses
4.To get the knowledge of effects of virus infection on cell growth and immune system defense against infectious diseases,
5.To provide overall exposure for the students towards the various aspects of the immunology and virology to come up with skilled approach in the field of biomedical research and academics.
Course Outcomes: At the end of the course, the students will be able to -
CO1: After completion of this course, student will be getting the fundamental knowledge on various aspects of Virology and will able to comprehend the molecular basis of numerous disease conditions.
CO2: Students will able to know cognitive and methodological tools necessary to understand the structure and life cycle of viruses.
CO3: Student will aware of viral evolution, know the mechanisms of host immune responses to viral infections.
CO4: Student will have deep theoretical knowledge on techniques employed for culturing and detection of plant and animal viruses.
CO5: Student will understand the mechanism of action of antiviral vaccine and drugs, which will help to carry out research and development on viral diseases

Contents –

Unit	Content	Teaching hours
1	**Historical and Conceptual Background** :History and principal of virology ,basic structure morphology and properties of viruses - Methods of study, Viral multiplication, Attachment, entry, un-coating, replication strategies, assembly, release, Cell transformations, Cultivation of viruses-Assay techniques.	9
2	**Classification of viruses and nomenclatures** Viral classification, nomenclature and taxonomy of viruses based on the nature of genome.DNA and RNA viruses- Picornaviruses. Flaviviruses- West Nile virus and Dengue virus. Corona viruses- SARS pathogen Lentiviruses.	9
3	**Plant Viruses and Animal viruses** Classification plant viruses and animal viruses. life cycle and pathogenicity of important viruses. Genome organization and replication of common DNA and RNA viruses, such as; TMV CaMV, Potato X Virus, Adeno virus, Pox virus, SV40, Gemini Virus, HIV, Influenza and Hepatitis Viruses. Transmission of plant and animal viruses by vectors and other means. Clinical diagnosis and treatment of HIV and Influenza.	9
4	**Virological Methods:** Cultivation and purification of viruses: Different in vivo and vitro growth systems for the bacterial, plant and animal viruses, determination of yields; purification of viruses using ultracentrifugation technique. Analytical techniques: chromatography technique, membrane filtration, mass spectroscopy, NMR, X-ray crystallography. Emerging techniques in viral diagnostics.	9
5	**Host Response and Antiviral Agents :**Immune responses to viruses, Interferon and other cytokines. Antiviral medications and their potential side effects. Antiviral therapy.	9

Text Books:

1. Medical virology 10 th edition by Morag C and Tim bury M C 1994.. Churchil Livingstone , London.
2. Introduction to modern virology 4 th Edition by Dimmock N J, Primrose S. B. 1994. Blackwell scientific publications. Oxford.
3. Virology 3rd edition by Conrat H. F. ., Kimball P. C. and Levy J. A. 1994. Prentice Hall, Englewood Cliff, New Jersy.
4. Principles of Bacteriology, Virology and Immunology, Topley Wilson 1995.

5. .Applied Virology. 1984. edited by Ednord Kurstak. Academic Press Inc.
Reference Books:
1. Flint, S. J., Enquist, L. W., Racaniello, V. R., & Skalka, A. M. (2015). Principles of Virology (Vol. 1, 4th ed.). ASM Press.
2. Mahy, B. W. J., & Van Regenmortel, M. H. V. (Eds.). (2009). Desk Encyclopedia of Human and Medical Virology. Academic Press.
3. Principles of virology. 2000 by Edward Arnold.
4. Cann, A. J. (2016). Principles of Molecular Virology (6th ed.). Academic Press.
5. Richman, D. D., Whitley, R. J., & Hayden, F. G. (Eds.). (2016). Clinical Virology (4th ed.). ASM Press.
Online Resources: 1. NPTEL / SWAYAM lectures.

Course code: MIC42MML203 **Course name:** Microbial Fermentation Course **category: Major Mandatory**
Credits: 2 **Teaching scheme:** L-2 **Evaluation scheme:** CA–30, ESE–20
Exam Duration: 01 Hr
Pre-requisites: The student should have basic knowledge of biological and applied sciences, and successfully completed the first year of the Degree Program.

Course Objectives:
1. This course introduces various aspects of applied and industrial microbiology.
2.The course helps the students to learn every important upstream and downstream components of fermentation process including strain selection, development, media design, formulation and recovery .
3.These course can educate the students about fermenter design, different types of fermentations and also helps the current trend of fermentation process in biotech-industry.
4.Overall, the course helps in the student's exposure on industrial applications of bioprocesses.approach in the field of biomedical research and academics.
Course Outcomes: At the end of the course, the students will be able to -
CO1: Enhancement of cell and product formation during fermentation process.
CO2: Analyse kinetics of cell and product formation in batch, continuous and fed-batch cultures
CO3: Differentiate the rheological changes during fermentation process.
CO4: This subject puts emphasis on the basic engineering principles of Fermentation Technology.
CO5: It also highlights the application of fermentation in biotechnological industry

Contents –

Unit	Content	Teaching hours
1	**Microbial growth kinetics :**Major types of organisms used in fermentation. Microbial growth kinetics, Batch culture, Continuous Culture, Fed – Batch – Types, applications, fermentation kinetics.	7
2	**The Isolation of industrially important microorganism:** Isolation, preservation and improvement of industrially important microorganisms, media for industrial fermentations – media formulation, Development of inoculum for industrial fermentations	7

3	**Design of fermenters :** Fermenter design and types-basic functions of a Fermenter for microbial and animal cell culture – alternative vessel design, common measurements and control systems. Sensors – solutions to common problems in fermentation, anaerobic fermentation.	8
4	**Purification of fermentation Products :** Filtration- Theory of filtration, Different types of filtration, use of filter acids. Centrifugation- Types of centrifugations. Cell Disruption-Chemical and Biological methods, Types of cellular description	8

Text Books:
1. Blanch, H. W., Clark, D. S., & Stevens, R. W. (2016). "Biochemical Engineering Fundamentals." McGraw-Hill Education.
2. Peleg, M., & Normand, M. D. (2018). "Fermentation and Food Safety." Springer
3. Bai, Dong-Mei. Biochemical Engineering and Biotechnology. 2014.
4. Gancedo, Carlos, and Serrano, Ramon. Ecological Aspects of Nitrogen Metabolism in Plants. 1983.
5. Stanbury, Peter F., and Whitaker, Andrew. Principles of Fermentation Technology. 2017.
Reference Books:
1. Smith, Corwin L. Fermentation Microbiology and Biotechnology. 2011.
2. Stanbury, Peter F., Whitaker, Andrew, and Hall, Stephen J. Principles of Fermentation Technology. 1995.
3. Blanch, Harvey W., and Clark, Donald S. Biochemical Engineering. 1996.
4. Reed, Gerald. Prescott and Dunn's Industrial Microbiology. 2002.
5. Vogel, Hermann G. A Textbook of Practical Organic Chemistry Including Qualitative Organic Analysis. 2009.
Online Resources: 1. NPTEL / SWAYAM lectures.

Course code: MIC42VSP201 **Course name:** Applied MI Lab **Course category:** Vocational skill course
Credits: 2 **Teaching scheme:** P-4 **Evaluation scheme:** CA–30, ESE–20
Exam Duration: 02 Hrs
Pre-requisites: The student should have basic knowledge of biological and applied sciences, and successfully completed the first year of the Degree Program.

Course Objectives:
1. This course focuses on applying theoretical knowledge practically for problem-solving in a hands- to foster teamwork skills through collaborative tasks within a team structure,
2.To develop critical thinking by addressing challenges in recent applied technology ,
3.To demonstrate technical proficiency relevant to the technology
4. To develop Presentation and communication skills for effective sharing of project outcomes. Students will be able to practice acquired knowledge within the chosen area of technology for project development.
5. Identify, discuss and justify the technical aspects of the chosen project with a comprehensive and systematic approach.
Course Outcomes: At the end of the course, the students will be able to -
CO1: Students will learn practically to work in lab and handle instruments .
CO2: They will develop teamwork skills through collaborative tasks within a team structure.
CO3: They will develop critical thinking by addressing challenges .
CO4: They will learn to demonstrate technical proficiency relevant
CO5: They will learn the skills of presentation and communication**.**

List of Practical:

Sr.No.	Title of the Experiment
1	Isolation of bacteriophage from sewage
2	One step growth curve for determination for virus titre
3	Phage typing of E. coli bacteriophages

4	Induction of lambda lysogen by UV radiations
5	Cultivation and assay of viruses using embryonated eggs and Tissue culture Technique
6	Isolation and Purification of genomic DNA from E.coli / Bacillus sp
7	Isolation and purification of Plasmid from plasmid bearing E.coli by alkaline lysis method
8	Detection and location of DNA : Spectrophotometrically, Diphenyl amine test, agarose gel electrophoresis
9	Isolation and purification of RNA from yeast, Quantitative estimation of RNA by Orcinol test
10	Determination of LD50 value for E.coli using ultraviolet radiations (UV survival pattern of E. coli/yeast)
11	Ampicillin selection method for isolation of auxotrophic mutant.(Replica plate method)
12	Studies on light and dark repair mechanisms in E. coli/yeast using UV radiations
13	Isolation of antibiotic resistant mutants by chemical mutagenesis.

Reference Book / Hand Books/ Lab Manual

1. Parija S.C. (2005) Text Book of Practical Microbiology, 1st edition, Ahuja Publishing House, New Delhi.
2. Dubey RC and Maheshwari DK (2004) Practical Microbiology, 1st edition, S. Chand and Co., Delhi.
3. Harley, J. P. and Prescott L. M. (2002) Laboratory Exercises in Microbiology, 5th edition, The McGraw-Hill Co., New York
4. Benson H. (2001) Microbiological Applications Lab Manual, 8 th edition, The McGrawHill Companies, New York
5. Aneja K.R. (1996) Experiments in Microbiology, 3rd edition, WishwaPrakashan, New
6. Sambrook, J., & Russell, D. W. (2001). Molecular Cloning: A Laboratory Manual (3rd ed.). Cold Spring Harbor, NY: Cold Spring Harbor Laboratory Press.

Course code: MIC42MMP201 **Course name:** Fermentation Technology Laboratory **Course category:** Major Mandatory
Credits: 01 **Teaching scheme:** P-2 **Evaluation scheme:** CA–30, ESE–20
Exam Duration: 02 Hrs
Pre-requisites: The student should have basic knowledge of biological and applied sciences, and successfully completed the first year of the Degree Program.

Course Objectives:
1.The main objective of this coarse to provide knowledge of cellular mechanisms like respiration and fermentation of different organisms for the production of products
2.Students will come to know about fermentation technology and their application for production of specific products
3.Students will come to know about to how to produce highest quality and quantity i.e large biomass of microbial cells
4.Students will come to know about how to produce microbial metabolites like lactic acid and ethanol from glucose, to produce microbial enzymes. 5.
Lab Outcomes: At the end of the course, the students will be able to -
LO1: Learners are equipped to become an entrepreneur in the field of industrial production of microbial products like antibiotics vitamins and enzymes.
LO2: Students will familiar and acquainted with fermentation technique.
LO3: Students will aware with chemical changes in organic substances through the action of enzymes.
LO4: Awareness regarding bio safety measures enables students to serve in an microbial industry in future.
LO5: Students will develop an understanding of different types of reactors / fermenters which are used for laboratory, pilot and industrial scale fermentations and their processes parameters.

List of Practical:

Sr.No.	Title of the Experiment
1.	Standard operating Procedure of laboratory (Compulsory practical)
2.	Isolation techniques of microbes by spread plate, pour plate and streak plate
3.	Formulation of culture media for fermentation process
4.	Production of acetic acid from acetobacter
5.	Production of lactic acid from Lactobacillus spp.
6.	Isolation od *A.niger* from onion
7.	To study Antibiotic assay
8.	To study preservation techniques
9.	Identification of *A.niger* by Infected samples
10.	Isolation of microorganisms from soil, air & water
11.	Effect of pH on growth of microorganisms
12.	Isolation of Azotobacter from soil sample
13.	Isolation of bacteriophage from sewage sample
14.	Estimation of amount of protein by Lowery's method
15.	To study paper Chromatograph
16.	Demonstration of utilization of sugars by oxidation and fermentation techniques.
17.	Isolation and characterization of (as nitrogen fixers) of Azospirillum and detection of IAA by Azospirillum

18.	Detection of siderophore production by Azospirillum and *Pseudomonas*
19.	Slide culture technique for yeast isolation.
20.	Cover slip culture technique for actinomycetes identification
21.	Microbial production, extraction, purification and confirmation of α- Amylase/ Protease/Lipase.
22.	Microbial production, extraction, purification and confirmation of Invertase/ Urease

Reference Book / Hand Books/ Lab Manual
1. Atlas, R. M. (1997) Principles of Microbiology, 2nd edition, W.M.T.Brown Publishers, Dubuque, USA.
2. Cappuccino J and Sherman N. (2010) Microbiology: A Laboratory Manual, 9th edition, Pearson Education Limited, New Delhi
3. Parija S.C. (2005) Text Book of Practical Microbiology, 1st edition, Ahuja Publishing House, New Delhi. House, New Delhi.
4. Dubey RC and Maheshwari DK (2004) Practical Microbiology, 1st edition, S. Chand and Co., Delhi.
5. Harley, J. P. and Prescott L. M. (2002) Laboratory Exercises in Microbiology, 5th edition, The McGraw-Hill Co., New York
6. Benson H. (2001) Microbiological Applications Lab Manual, 8 th edition, The McGrawHill Companies, New York
7. Aneja K.R. (1996) Experiments in Microbiology, 3rd edition, WishwaPrakashan, New

Course code:MIC42FPJ201 Course name: Field Project Course category: Field Project
Credits: 2 **Teaching scheme:** P-4 **Evaluation scheme:** CA–30, ESE–20
Exam Duration: 02 Hrs
Pre-requisites: The student should have basic knowledge of biological and applied sciences, and successfully completed the first year of the Degree Program.

Course Objectives:
1. Project objectives are what you plan to achieve by the end of your project.
2.This might include deliverables and assets, or more intangible objectives like increasing productivity or motivation.
3.Your project objectives should be attainable, time- bound, specific goals you can measure at the end of your project.
Course Outcomes: At the end of the course, the students will be able to -
CO1: Students will be able to practice acquired knowledge within the chosen area of technology for development.
CO2: Identify, discuss and justify the technical aspects of the chosen project with a comprehensive and systematic approach.

List of Practical:

Sr.No.	Title of the Experiment
1	**Ideas of project:** Defining project ideas is crucial for setting realistic expectations and laying out a clear vision for a project life cycle. Project-based learning not only provides opportunities for students to collaborate or drive their own learning, but it also teaches them skills such as problem solving, and helps to develop additional skills integral to their future, such as critical thinking and time management.
2	**Literature survey:** A literature review establishes familiarity with and understanding of current research in a particular field before carrying out a new investigation. Conducting a literature review should enable you to find out what research has already been done and identify what is unknown within your topic.

3	**Performance:** Performance measurement during a project is to know how things are going so that we can have early warning of problems that might get in the way of achieving project objectives and so that we can manage expectations. The criteria of it as given below.
4	**Implementation:** Follows closely the design, uses appropriate techniques with skill and understanding to produce a good solution.
5	**Evaluation:** Clearly relates to the problem. Shows a good understanding and appreciation of the solution. Objectives of what has been done.
6	**Project Log:** a. The individual student's effort and commitment. b. The quality of the work produced by the individual student. c. The student's integration and co-operation with the rest of the group. d. The completeness of the logbook & time to time signature of guide
7	• Thrust Area **1. Antimicrobial resistance** **2. Host Microbe interactions (Plants, Animals, Humans,)** **3. Microbial genomics** **4. Microbial analysis** **5. Bioremediation** **6. Microbial ecology** **7. Bioprospecting (Biofuel, Biofertilizer, etc)** **8. Microbial pathogenesis** **9. mRNA technology** **10. Synthetic biology** **11. Cyanobacterial and algal biotechnology**

Sr. No.	Activities	Responsibilities
1	PG students are deciding on their team members for their semester project with their proposed project domain and title	Project head, PG students
2	Director shall allocate the project guide based on their area of expertise (ot more than 3 batches to a guide)	Director
3	Ensuring that students have regular discussion meetings with their project guides.	Project guide Project head
4	Synopsis preparation and submission	Project head

5	Verification of student project log book	Project guide Project head
6	Approval of PPT: Abstract, existing, proposed system. 30% of proposed work. 80% of proposed work. 100% of proposed work.	Project guide
7	Preparation and submission of progress report during project	Students Project head
8	Preparing list for Redo students (insufficient content, plagiarism, poor presentation, genuine absentees.	Project head
9	Submission of hard copy of project report	Project head
10	Evaluation of project report	External examiner
11	Organizing final project viva-voce	Project heads
12	Ensuring that if a candidate fails to submit the project report on or before the specified deadline , he/she is deemed to have failed in the project work and shall re – enroll for the same	Project head Project guide Director

Second Year- Semester IV												
Course Category	**Course Code**	**Course Title**	**Nature of Course**	**No. of Credits**	**Teaching (Contact Hrs/ week)**		**Evaluation Scheme (Marks)**			**Minimum Passing (Marks)**		
					L	**P**	**Internal**	**External**	**Total**	**Internal**	**External**	**Total**
MM	MIC42MML 204	Genome Maintenance and Regulation	Lecture	2	2	-	30	20	50	-	08	20
MM	MIC42MML 205	Advance Fermentation Technology	Lecture	3	3	-	60	40	100	-	16	40
MM	MIC42MML 206	Molecular Basis of Bacterial Infection	Lecture	2	2	-	30	20	50	-	08	20
OE		**Open Elective VI**	Lecture	2	2	-	30	20	50	-	08	20
MI		Annexture I	Lecture	3	3	-	60	40	100	-	16	40
AEC	MGM54AEL 203	Communication skills	Lecture	2	2	-	30	20	50	-	08	20
SEC	MIC42SEP201	Infection control Lab	Practical	2		4	30	20	50	-	08	20
MI		Minor Course	Practical	1	-	2	30	20	50	-	08	20
MM	MIC42MMP 202	Advance Fermentation Laboratory	Practical	1	-	2	30	20	50	-	08	20
CEP	MIC42CEJ201	Community Engagement and Service (Field project)	Project	2	-	4	30	20	50	-	08	20
CC	MGM73CCP 105	**Fine Arts**	Practical	2		4	30	20	50	-	08	20
Total 30				**22**	**14**	**16**	390	260	650	-	104	260

Note:

Nature of Course : L- Lecture, P-Practical, S-Seminar, J-Project, I-Internship, D-Dissertation,

Course Category: MM-Major Mandatory, ME-Major Elective, MI-Minor, OE-Generic / Open electives, VSC-Vocational skill course, SEC-Skill Enhancement course, AEC-Ability Enhancement course, IKS-Indian Knowledge system, VEC-Value Education course, OJT-On Job Training / Internship / Apprenticeship, FP-Field project, CEP-Community engagement and service, CC-Co – curricular course, RM-Research methodology, RP-Research project

Semester-IV

Course code: MIC42MML204 **Course name:** Genome Maintenance and Regulation **Course category:** Major Mandatory
Credits: 2 **Teaching scheme:** L-2 **Evaluation scheme:** CA–30, ESE–20
Exam Duration: 01 Hr
Pre-requisites: The student should have basic knowledge of biological and applied sciences, and successfully completed the first year of the Degree Program.

Course Objectives:
1. The course Ensured accurate DNA replication to maintain genetic integrity,Repairing DNA damage to prevent mutations and maintain genome stability,
2. Facilitating chromosome organization to ensure proper segregation during cell division,
3.Monitoring and correcting epigenetic modifications for gene regulation and cellular identity
4.Students will well familiar with genome maintenance and regulation
Course Outcomes: At the end of the course, the students will be able to -
CO1: Understand the mechanisms of DNA repair pathways and their implications in maintaining genomic integrity.
CO2: Analyse the role of epigenetic modifications in regulating gene expression and genome stability.
CO3: Investigate the interplay between DNA replication, recombination, and chromatin organization in genome maintenance.
CO4: Evaluate the impact of environmental factors and cellular stress on genome stability and adaptation.
CO5: Apply bioinformatics tools and techniques for studying genome maintenance and regulatory processes.

Contents –

Unit	Content	Teaching hours
1	**Basics of gene expression:** Regulatory elements/ factors: Inculcate concepts with suitable examples for; Cis acting elements, Trans-acting factors. Regulation of transposition of Tn3 and Tn9. Concept of Activator, Coactivator, Repressor (with suitable examples). Examples with mechanisms; specific regulator and global regulator.	7
2	**Regulation of Gene expression in Prokaryotes:** General aspects of Regulation, transcriptional regulation - inducible and repressible system, positive regulation and negative regulation; Operon concept – lac, trp, Ara operons, relative positions of Promoters and Operators, Regulons, Regulation of Translation, Regulation of the synthesis of Ribosomes.	8

3	**Gene expression in Eukaryotes:** Regulatory strategies in Eukaryotes, Regulation mediates through Transcription factors, Regulation of enhancer activity, role of nucleosome and posttranslational modifications in transcription, methylation and epigenetics, Regulation of processing, regulation through RNA splicing, RNA degradation and RNA interference	8
4	**Damage repair and mutation:** Causes (spontaneous, chemical agent, radiation) and types of DNA damage. Mechanism of DNA repair: Direct, Base excision, nucleotide excision, mismatch repair. Types of mutations: missense, nonsense, point, silent and frame shift mutation.	8

Text Books:
1. Molecular Biology of the Cell" by Bruce Alberts . -
2. "Principles of Genetics" by D. Peter Snustad and Michael J. Simmons -
3. "Genomes" 2012 by T.A. Brown -
4. "DNA Repair and Mutagenesis" by Errol C. Friedberg
5. Molecular Biology of the Cell" by David Frifielder
Reference Books:
1. Snustad, D. P., & Simmons, M. J. (2015). Principles of Genetics (6th ed.). Hoboken, NJ: John Wiley & Sons.
2. Hartwell, L. H., Goldberg, M. L., Fischer, J. A., & Hood, L. (2017). Genetics: From Genes to Genomes (6th ed.). New York, NY: McGraw-Hill Education.
3. Snyder, L., & Peters, J. E. (2013). Molecular Genetics of Bacteria (3rd ed.). Washington, DC: ASM Press.
4. Baker,. (2013). Molecular Biology of the Gene (7th ed.). Cold Spring Harbor, NY: Cold Spring Harbor Laboratory Press.
5. Watson, J. D., Baker, T. A., Bell, S. P., Gann, A., Levine, M., & Losick, R. (2013). Molecular Biology of the Gene (7th ed.). Cold Spring Harbor, NY: Cold Spring Harbor Laboratory Press.
Online Resources: 1. NPTEL / SWAYAM lectures.

Course code: MIC42MML205 **Course name: Advanced Fermentation Technology**
Course category: Major Mandatory
Credits: 3 **Teaching scheme:** L-3 **Evaluation scheme:** CA–60, ESE–40
Exam Duration: 02 Hrs
Pre-requisites: The student should have basic knowledge of biological and applied sciences, and successfully completed the first year of the Degree Program.

Course Objectives:
1.The objective of the course work is to study Master principles of advanced microbial fermentation processes for biotechnological applications,
2.To develop expertise in optimizing fermentation parameters for enhanced product yield and quality also Gain proficiency in the utilization of advanced bioreactor systems and control strategies,
3.To Explore cutting-edge techniques for genetic engineering and metabolic pathway manipulation in fermentation organisms.
4.To Understand the integration of downstream processing techniques for the purification and recovery of fermented products
Course Outcomes: At the end of the course, the students will be able to -
CO1: This course introduces various aspects of applied and industrial microbiology.
CO2: The course helps the students to learn every important upstream and downstream components of fermentation process including strain selection, development, media design, formulation and recovery of products.
CO3: Additionally, the course can educate the students about fermenter design, different types of fermentations and also the current trend of fermentation process in biotech- industry.
CO4: Overall, the course helps in the student's exposure on industrial applications of bioprocesses.

Contents –

Unit	Content	Teaching hours
1	**Media for industrial fermentation:** Media components and formulation, Types of carbon source, Nitrogen source and Amino acids, Minerals and trace elements, Vitamins and growth factors, pH adjustments and buffer systems, Sterilization and Aseptic techniques, Media optimization and Strategies, Oxygen requirement, Antifoams	9
2	**Sterilization:** Medium sterilization, Design for batch and continuous sterilization,	9

	Fermenter sterilization, Feeds, Filter sterilization, Equipment sterilization, Validation and monitoring, Sterility Assurance.	
3	**The development of Inoculate for industrial fermentation:** Microbial strain selection, Genetic engineering and strain improvement, culture maintenance and preservation, Inoculum preparation and maintenance, Fermentation kinetics and growth modeling, Quality control and assurance, Scale up consideration.	9
4	**Instrumentation and Control:** Classes of sensors, Methods of measuring process variables, online analysis, Computer control system, Safety and Regulatory Compliance.	9
5	**Effluent treatment:** Introduction to Effluent treatment, Effluent treatment process (Physical, Chemical, Biological Methods) Dissolved Oxygen Concentration as an Water quality indicator, Strength, Treatment and Disposal, Design and operation of treatment facilities	9

Text Books:
1. Fermentation Microbiology and Biotechnology"1999 by E. M. T. El-Mansi and Chris A. Hill
2. Fermentation and Biochemical Engineering Handbook: 2010 Principles, Process Design, and Equipment" edited by Henry C. Vogel:
3. Industrial Microbiology Casida 2012
4. Smith, J. A. (2019). *Industrial Biotechnology: Principles and Applications.* Wiley.
5. Anderson, K. L., & White, G. F. (2021). *Industrial Microbiology and Biotechnology.* ASM Press.
Reference Books:
1. Stanbury, P. F., Whitaker, A., & Hall, S. J. (2017). Principles of fermentation technology.
2. Bioprocess Engineering: Basic Concepts" by Michael L. Shuler, Fikret Kargi, Matthew DeLisa
3. "Industrial Microbiology: An Introduction" by Michael J. Waites, Neil L. Morgan, John S. Rockey, Gary Higton
4. "Bioprocess Engineering Principles" by Pauline M. Doran
5. Stanbury, P. F., Whitaker, A., & Hall, S. J. (2017). Principles of fermentation technology.
6. Bioprocess Engineering: Basic Concepts" by Michael L. Shuler, Fikret Kargi, Matthew DeLisa

Course code: MIC42MML206 **Course name:** Molecular Basis of Bacterial Infection **Course category:** Major Mandatory
Credits: 2 **Teaching scheme:** L-2 **Evaluation scheme:** CA–30, ESE–20
Exam Duration: 01 Hr
Pre-requisites: The student should have basic knowledge of biological and applied sciences, and successfully completed the first year of the Degree Program.

Course Objectives:
1. The course has an objective of Key genetic pathways driving bacterial virulence
2.Students come to know to Identify host-pathogen protein interactions crucial for infection, understanding bacterial evasion mechanisms against host immune responses.
3.To characterizing bacterial gene expression dynamics during infection
4.To developing targeted antimicrobial strategies based on molecular vulnerabilities.
Course Outcomes: At the end of the course, the students will be able to -
CO1: Understand the mechanisms of bacterial pathogenesis at the molecular level.
CO2: Analyze the role of bacterial virulence factors in infection and disease progression.
CO3: Evaluate host-pathogen interactions and immune responses to bacterial invasion.
CO4: Apply molecular techniques to study bacterial infection dynamics and antibiotic resistance.
CO5: Develop strategies for targeted intervention and control of bacterial infections based on molecular insights.

Contents –

Unit	Content	Teaching hours
1	**Skin and Mucosa:** The First Lines of defence against Bacterial Infections Mechanism of bacterial infection, types of bacterial infection, virulence factor, difference between pathogenicity & virulence Barriers: Skin and Mucosal Membranes, Defenses of the Skin, Epidermis, Normal Micro biota, Defenses of the Dermis, Defenses of Mucosal Surfaces, Special Defenses of the Gastrointestinal Tract.	8
2	**Overview of the Human Micro biota** Definition of microbiota, Different types of microorganisms present in the human body (bacteria, viruses, fungi, etc.) Roles of microbiota in digestion and nutrient absorption.Skin Micro biota, Oropharyngeal Microbiota, Microbiota of the Small Intestine and Colon, Microbiota of the Vaginal Tract, Probiotics, prebiotics, and synbiotics.	8

3	**Gram-Positive Opportunistic Pathogens** Brief overview of Gram-positive bacteria and their characteristics. Definition and characteristics of opportunistic pathogens. Clinical significance of Gram-positive opportunistic pathogens (e.g., Staphylococcus aureus, Enterococcus spp., Streptococcus spp.) Mechanisms of pathogenesis employed by Gram-positive opportunistic pathogens.	7
4	**Gram-Negative Opportunistic Pathogens** Introduction to Gram negative bacteria. Structural components unique to Gram-negative bacteria (outer membrane, lipopolysaccharide layer, etc.) Pseudomonas, Escherichia coli, Klebsiella, Acinetobacter, etc.) Mechanisms by which Gram-negative pathogens cause disease (endotoxins, exotoxins, adhesion molecules, etc.	7

Text Books:
1. Medical Microbiology" 2020 by Patrick R. Murray, Ken S. Rosenthal, and Michael A. Pfaller.
2. Medical Microbiology" by Geo. F. Brooks, Karen C. Carroll, Janet S. Butel, and Stephen A. Morse 2019 (28th edition).
3. Brock Biology of Microorganisms" by Michael T. Madigan, Kelly S. Bender, Daniel H. Buckley, W. Matthew Sattley, and David A. Stahl: 2019 (15th edition).
4. Foundations in Microbiology" by Kathleen Park Talaro and Barry Chess: 019 (10th edition).
5. Textbook of Microbiology Ananatnarayan and panilar 2007 11 th edition
Reference Books:
1. Bacterial Pathogenesis: (2001)A Molecular Approach 3 rd edition by Brenda A. Wilson, Abigail A. Salyers, Dixie D. Whitt, Malcolm E. Winkler
2. Molecular Basis of Bacterial Pathogenesis by Barbara H. Iglewski and Virginia L
3. Willey, J. M., Sherwood, L. M., & Woolverton, C. J. (2020). Prescott's Microbiology. McGraw-Hill Education.
4. Levinson, W., & Chin-Hong, P. V. (2019). Review of Medical Microbiology and Immunology. McGraw-Hill Education.
5. Brooks, G. F., Carroll, K. C., Butel, J. S., & Morse, S. A. (2018). Jawetz, Melnick, & Adelberg's Medical Microbiology. McGraw-Hill Education.

Course code: MIC42SEC201	**Course name:** Infection control Lab
Course category: Skill Enhancement Course	
Credits: 2 **Teaching scheme:** P-4	**Evaluation scheme:** CA–30, ESE–20
Exam Duration: 02 Hrs	
Pre-requisites: The student should have basic knowledge of biological and applied sciences, and successfully completed the first year of the Degree Program.	

Course Objectives:
1. These course introduced to understand the maintenance of hygiene in working laboratory to familiarize
2.Students will know common disinfectants and their application,
3.Students familiarized with biosafety cabinets and their purpose
4.To understand the principle of antibiotic susceptibility testing and the principle of waterborne pathogens in samples and to understand the proper waste disposal procedures.
Course Outcomes: At the end of the course, the students will be able to -
CO1: Improve understanding of the significance of hand hygiene.
CO2: Increased knowledge of disinfection methods.
CO3: Adhere to safe working practices
CO4: Improve interpretation of antibiotic sensitivity results & microbial contamination results.
CO5: Safe and appropriate disposal of biohazardous waste.

List of Practical:

Sr. No.	Title of the Experiment
1.	Hand washing and sanitization techniques: A demonstration
2.	Autoclaving techniques- Steam
3.	Sterilization techniques- Chemicals and physical
4.	common disinfectants for control microbial contamination on laboratory surfaces.
5.	Basic microbial staining techniques for visualizing bacterial morphology.
6.	Biosafety cabinets and reinforce safe working practices.
7.	Disposal of biohazardous waste.
8.	Antibiotic susceptibility testing.
9.	Basic microbial culturing techniques.
10.	Demonstrate the use of handheld UV-C devices for surface disinfection.
11.	Demonstrate the importance of controlling airborne pathogens in the laboratory.

12.	Detection of waterborne pathogens.
13.	To isolate and identify common pathogens from clinical samples.
14.	Basic principles of preventing foodborne infections.
15.	Identification of Staphylococcus aureus by phage typing.
16.	Differentiation of streptococci by bacitracin test
17.	Differentiation of streptococci by CAMP test
18.	Isolation of microflora from human skin.
19.	Identification of streptococcus by bile solubility test.
20.	Isolation of enteric pathogens from stool by direct plating method.
21.	Hand washing and sanitization techniques: A demonstration
22.	Autoclaving techniques- Steam

Reference Book / Hand Books/ Lab Manual
1. Dubey RC and Maheshwari DK (2004) Practical Microbiology, 1st edition, S. Chand and Co., Delhi.
2. Benson, H. J. (1985). Microbiological Applications: A Laboratory Manual in General Microbiology.
3. D.K. Maheshwari. (2002). Practical Microbiology. S. Chand Publishing
4. Harley, J. P. and Prescott L. M. (2002) Laboratory Exercises in Microbiology, 5th edition, The McGraw-Hill Co., New York
5. Benson H. (2001) Microbiological Applications Lab Manual, 8 th edition, The McGrawHill Companies, New York
6. Aneja K.R. (1996) Experiments in Microbiology, 3rd edition, WishwaPrakashan, New

Semester-IV

Course code: MIC42MMP202 **Course name: Advanced fermentation Laboratory** **Course category: Major Mandatory**
Credits: 1 **Teaching scheme:** P-2 **Evaluation scheme:** CA–30, ESE–20
Exam Duration: 02 Hrs
Pre-requisites: The student should have basic knowledge of biological and applied sciences, and successfully completed the first year of the Degree Program.

Course Objectives:
11.These course has to design to develop practical skills in handling microbial cultures, preparing fermentation media, and operating equipment
2.These course has to learn how to design and plan fermentation experiments, considering variable, control and safety measures .
3.Students will acquire skills in data collection during fermentation, including sampling and measurement techniques
4.Students will learn the principles of microbial strain selection and, if applicable, genetic engineering for improved fermentation outcomes.
Course Outcomes: At the end of the course, the students will be able to -
CO1: Improved laboratory techniques, aseptic practices, and equipment proficiency.
CO2: Ability to design and execute fermentation experiments independently.
CO3: Ability to troubleshoot and modify experiments for optimal results.
CO4: Understand the impact of microbial strain on fermentation process.
CO5: Development of teamwork skills through collaborative experiments, data sharing, and problem-solving.

List of Practical:

Sr.No.	Title of the Experiment
1.	Fermentation Of Carbohydrates.
2.	Penicillin production
3.	Pectinase production.
4.	Urease production.
5.	Xanthan Gum Production

6.	L-Phenylalanine production using E. Coli
7.	Tryptophan production using E. Coli
8.	Isolation Of Casein from Milk Sample.
9.	Fermentative Production of Amylase by Bacillus Subtilis.
10.	Extraction Of Alpha Amylase by Using Microbes.
11.	Production Of Citric Acid from Aspergillus Niger Species.
12.	Single Cell Protein production.
13.	Production of Vinegar by Using Different Fruits.
14.	Production of Wine from Grape Juice.
15.	Fermented beverage made from malted barley, water, hops, and yeast. (beer)
16.	Production of Ethanol by Using Saccharomyces Cerevisiae (Upstream Process).
17.	Extraction of Ethanol by Distillation Method (Downstream Process).
18.	Various types of cheese production through the fermentation of milk by specific bacteria and enzymes Microbial Analysis of Food Items.
19.	Detection of Protease Production By Bacterial Culture (E.coli)
20.	Convert lignocellulosic materials into biofuel feedstocks for sustainable energy production.
21.	Fermentation Of Carbohydrates.
22.	Penicillin production

Reference Book / Hand Books/ Lab Manual
1. 1.Benson, H. J. (1985). Microbiological Applications: A Laboratory Manual in General Microbiology.
2. 2.D.K.Maheshwari. (2002). Practical Microbiology. S. Chand Publishing
3. Dubey RC and Maheshwari DK (2004) Practical Microbiology, 1st edition, S. Chand and Co., Delhi.
4. Harley, J. P. and Prescott L. M. (2002) Laboratory Exercises in Microbiology, 5th edition, The McGraw-Hill Co., New York

5. Benson H. (2001) Microbiological Applications Lab Manual, 8 th edition, The McGrawHill Companies, New York
6. Aneja K.R. (1996) Experiments in Microbiology, 3rd edition, WishwaPrakashan, New

Course code: MIC42CEJ201 Course name: Field Project Course category: Community Engagement and Service (Field project)
Credits: 2 **Teaching scheme:** P-4 **Evaluation scheme:** CA–30, ESE–20
Exam Duration: 02 Hrs
Pre-requisites: The student should have basic knowledge of biological and applied sciences, and successfully completed the first year of the Degree Program.

Course Objectives:
1. The purpose of the mini-project is to allow you to explore the breadth of research that is being performed within the college.
2.To Identify, discuss and justify the technical aspects of the chosen project with a comprehensive and systematic approach ,
3.To provide students with practical, hands-on experience in applying theoretical knowledge ,to enhance students' research skills.
4. Group projects enable students to work together, share responsibilities, and learn from diverse perspectives, preparing them for collaborative work environments.
LAB Outcomes: At the end of the course, the students will be able to -
LO1: Students will be able to practice acquired knowledge within the chosen area of technology for project development.
LO2: Projects help students to analyze information, make decisions, and solve problems, contributing to the development of critical thinking skills.
LO3: Students develop the ability to gather, evaluate, and synthesize information from various sources, improving their research and information literacy skills.
LO4: Students gain practical experience applying academic skills, preparing them for real-world challenges in their future careers.
LO5: Group projects promote teamwork and collaboration, helping students develop interpersonal skills and the ability to work effectively in a team.

Sr.No.	Title of the Experiment
1	**Ideas of project:** Defining project ideas is crucial for setting realistic expectations and laying out a clear vision for a project life cycle. Project-based learning not only provides opportunities for students to collaborate or drive their own learning, but it also teaches them skills such as problem solving, and helps to develop additional skills integral to their future, such as critical thinking and time management.
2	**Literature survey:** A literature review establishes familiarity with and understanding of current research in a particular field before carrying out a new investigation. Conducting a literature review should enable you to find out what research has already been done and identify what is unknown within your topic.
3	**Performance:** Performance measurement during a project is to know how things are going so that we can have early warning of problems that might get in the way of achieving project objectives and so that we can manage expectations. The criteria of it as given below.
4	**Implementation:** Follows closely the design, uses appropriate techniques with skill and understanding to produce a good solution.
5	**Evaluation:** Clearly relates to the problem. Shows a good understanding and appreciation of the solution. Objectives of what has been done.
6	**Project Log:** a. The individual student's effort and commitment. b. The quality of the work produced by the individual student. c. The student's integration and co-operation with the rest of the group. d. The completeness of the logbook & time to time signature of guide
7	• **Thrust Area** **1. Antimicrobial resistance** **2. Host Microbe interactions (Plants, Animals, Humans)** **3. Microbial genomics** **4. Bioremediation** **5. Microbial ecology** **6. Bioprospecting (Biofuel, Biofertilizer, etc)** **7. Microbial pathogenesis** **8. mRNA technology** **9. Synthetic biology** **10. Cyanobacterial and algal biotechnology**

PROCEDURE

Sr. No.	Activities	Responsibilities
1.	PG students are deciding on their team members for their semester project with their proposed project domain and title	Project head, UG students
2.	Director shall allocate the project guide based on their area of expertise (ot more than 3 batches to a guide)	Director
3.	Ensuring that students have regular discussion meetings with their project guides.	Project guide Project head
4.	Synopsis preparation and submission	Project head
5.	Verification of student project log book	Project guide Project head
6.	Approval of PPT: Abstract, existing, proposed system. 30% of proposed work. 80% of proposed work. 100% of proposed work.	Project guide
7.	Preparation and submission of progress report during project	Students Project head
8.	Preparing list for Redo students (insufficient content, plagiarism, poor presentation, genuine absentees.	Project head
9.	Submission of hard copy of project report	Project head
10.	Evaluation of project report	External examiner
11.	Organizing final project viva-voce	Project heads
12.	Ensuring that if a candidate fails to submit the project report on or before the specified deadline , he/she is deemed to have failed in the project work and shall re – enrol for the same	Project head Project guide Director