

MGM UNIVERSITY, AURANGABAD

INSTITUTE OF BIOSCIENCES AND TECHNOLOGY

CHOICE-BASED CREDIT SYSTEM (CBCS) SEMESTER PATTERN

Faculty of Basic and Applied Sciences Graduate (UG) Program

Microbiology - CURRICULUM W.e.f. Academic Year 2023-24

B.Sc., B. Sc. (Hons.), B. Sc. (Hons.) with Research of Microbiology

SEMESTER (I,II)

Prepared By Dr. N. S. Gore Submitted By Dr. S. V. Maske

Approved By Board of Studies

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 Program mes	Certificate Programmes
B.Sc. Biotechnology		Ph.D.		
Honours / Honours with	M.Sc. Biotechnology	Biotechnology		
Research				
B.Sc. Microbiology	M Sc Microbiology/	Ph.D. Microbiology		
Honours/ Honours with	Virology			
Research	vnology			
B.Sc. Bioinformatics	M.Sc.	Ph.D. Bioinformatics		
Honours / Honours with	Bioinformatics			
Research	Diomiormatics			
B.Sc. Food Technology and		Ph.D.Food		
Processing	M.Sc. Food	Technology &		
Honours / Honours with	Technology	Dragogging		
Research		Processing		
B.Sc. Food nutrition and	M.Sc. Plant	Ph.D.Plant Breeding		
Ditetics	Breeding and	& Molecular		
Honours / Honours with	Malandar Constin	Constian		
Research	Molecular Genetics	Genetics		
B. Tech. Biomedical		Ph.D. Plant		
Engineering		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 / PERA CET / JEE (MHT-CET / PERA CET / State Network Paper-I over the candidates who obtained non-zero score in MGMU-CET / MHT-CET / PERA CET / MHT-CET / PERA CET / JEE Mains Paper-I over the candidates who obtained non-zero score in MGMU-CET / MHT-CET / PERA CET / State Network 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 Yea	ar- Semester I										
Cour se Cate gory	Course Code	Course Title	Nature of Course	No. of Cre dits	Teac (Con hr wee	hing tact s/ ek)	Evalu	ation Sc (Marks)	heme	Mini	mum Pa (Marks)	issing)
					L	Р	Inte rnal	Exte rnal	Tot al	Inte rnal	Exte rnal	Tota l
MM	MIC42M ML103	Microbial Physiology and Metabolism	Lecture	2	2		30	20	50	-	08	20
MM	MIC42M ML104	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	MGM54 AEL101	Communicative English	Lecture	2	2	-	30	20	50	-	08	20
OE* *		Open Elective I	Lecture	2	2	-	<mark>3</mark> 0	20	50		08	20
OE		Open Elective II	Lecture	2	2	-	30	20	50		08	20
VEC *	MGM21 VEL102	Universal Human Values	Lecture	2	2	-	30	20	50	-	08	20
VSC *	MIC42V SP102	Micro Lab II	Practical	2		4	30	20	50	-	08	20
SEC *	MIC42S EP102	Explorations in Microbiology – I	Practical	2		4	30	20	50	-	08	20
MM	MIC42M MP102	Bio-Skills Sets Laboratory-I	Practical	1	-	2	30	20	50	-	08	20
CC	MGM82 CCP103	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 Y	'ear- Semest	er II										
Cour se Cate gory	Course Code	Course Title	Nature of Course	No. of Cre dits	Teac (Con hr wee	hing tact s/ ek)	Ev Schei	valuation me (Mai	n rks)	Mini	mum Pa (Marks)	nssing)
					L	Р	Inte rnal	Exte rnal	To tal	Inte rnal	Exte rnal	Tota l
MM	MIC42M ML103	Microbial Physiology and Metabolism	Lectur e	2	2		30	20	50		08	20
MM	MIC42M ML104	Biology: Concept, Connections, Investigation and applications	Lectur e	3	3	-	60	40	10 0		16	40
MI		Minor Course	Lectur e	2	2	-	30	20	50		08	20
AEC	MGM54 AEL101	Communicative English	Lectur e	2	2	-	30	20	50		08	20
OE* *		Open Elective I	Lectur e	2	2	-	30	20	50		08	20
OE		Open Elective II	Lectur e	2	2	-	30	20	50		08	20
VEC *	MGM21 VEL102	Universal Human Values	Lectur e	2	2	/_	30	20	50		08	20
VSC *	MIC42V SP102	Micro Lab II	Practic al	2		4	30	20	50		08	20
SEC *	MIC42S EP102	Explorations in Microbiology –I	Practic al	2		4	30	20	50		08	20
MM	MIC42M MP102	Bio-Skills Sets Laboratory-I	Practic al	1	-	2	30	20	50		08	20
СС	MGM82 CCP103	Sports	Practic al	2	-	4	30	20	50		08	20
		Total		22	15	14	360	240	60 0	-	96	240

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-Seme	ster III										
Cours e Categ ory	rs Course Code Course Title		Natur e of Cours e	No. of Cred its	Tea (Co H wa	achin g ntact Irs/ eek)	Evalua (ation Sch Marks)	eme	Minimu (I	ım Passi Marks)	ng
•					L	Р	Inter nal	Exter nal	Tot al	Inter nal	Exter nal	Tot al
MM	MIC42MM L201	Molecular Biology of Gene	Lectur e	2	2	-	30	20	50	-	08	20
MM	MIC42MM L202	Virology	Lectur e	3	3	-	60	40	100	-	16	40
MM	MIC42MM L203	Microbial Fermentation	Lectur e	2	2	-	30	20	50	I	08	20
OE		Open Elective V	Lectur e	2	2	-	30	20	50	I	08	20
MI		Minor Course	Lectur e	3	3	-	60	40	100	I	16	40
AEC	MGM54A EL103	Functional Hindi	Lectur e	2	2	-	30	20	50	-	08	20
VSC	MIC42VSP 201	Applied MI Lab	Practic al	2	-	4	30	20	50	-	08	20
MI		Minor Course	Practic al	1	-	2	30	20	50	-	08	20
MM	MIC42MM P201	Fermentation Technology Laboratory	Practic al	1	-	2	30	20	50	-	08	20
FP	MIC42FPJ2 01	Field Project	Project	2	-	4	30	20	50	-	08	20
СС	MGM82C CP201	Health and Wellness	Practic al	2	-	4	30	20	50	-	08	20
Total				22	14	16	390	260	650	-	104	260

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 Y	ear- Semester	IV										
Course Catego ry	Course Catego Course Code Course Title y		Natur e of Cours e	No. of Credi ts	Tead (Co Hrs wee	ching ntact / k) P	Evaluat (Marks)	ion Schem) Exter	e Tot	Minimu (Marks) Intern	um Passing) Exter	g Tot
				••		-	al	nal	al	al	nal	al
MM	MIC42MML 204	Genome Maintenance and Regulation	Lectur e	2	2	-	30	20	50	-	08	20
MM	MIC42MML 205	Advance Fermentatio n Technology	Lectur e	3	3	-	60	40	100	-	16	40
MM	MIC42MML 206	Molecular Basis of Bacterial Infection	Lectur e	2	2	-	30	20	50	-	08	20
OE		Open Elective VI	Lectur e	2	2	-	30	20	50	-	08	20
MI		Annexture I	Lectur e	3	3	-	60	40	100	-	16	40
AEC	MGM54AEL 203	Communicat ion skills	Lectur e	2	2	-	30	20	50	-	08	20
SEC	MIC42SEP20 1	Infection control Lab	Practi cal	2		4	30	20	50		-08	20
MI		Minor Course	Practi cal	1	-	2	30	20	50		08	20
MM	MIC42MMP 202	Advance Fermentatio n Laboratory	Practi cal	1	-	2	30	20	50		08	20
CEP	MIC42CEJ20 1	Community Engagement and Service (Field project)	Projec t	2	-	4	30	20	50	-	08	20
CC	MGM73CCP 105	Fine Arts	Practi cal	2		4	30	20	50	-	08	20
Total 30				22	14	16	390	260	650	-	104	260

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 Ye	ear- Semester V											
Course Catego ry	Course Code	Course Title	Natur e of Cours e	No. of Credi ts	Tea (Co th we	chin g ntac urs/ eek)	Evalu	ation Scho (Marks)	eme	Mini	mum Pass (Marks)	ing
					L	Р	Intern al	Extern al	Tot al	Intern al	Extern al	Tot al
MM	MIC42MML 301	Soil and Environme nt Microbial Biotechnol ogy	Theor y	2	2	-	30	20	50	-	08	20
MM	MIC42MML 302	Wine and Brewing Microbiolo gy	Theor y	3	3	-	60	40	100	-	16	40
MM	MIC42MML 303	Molecular Microbiolo gy	Theor y	2	2	-	30	20	50	-	08	20
ME	MIC42MEL2 01	Microbial Mechanism s of Foodborne disease	Theor y	3	3	-	60	40	100	-	16	40
MI		Minor Course	Theor y	3	3	-	60	40	100		16	40
VSC	MIC42VSL3 01	Python Lab	Practic al	2		4	30	20	50	-	08	20
VSC	MIC42VSP3 01	Mini Project	Practic al	2		4	30	20	50		08	20
MI		Minor Course	Practic al	1	-	2	30	20	50		08	20
MM	MIC42MMP 301	Microbial Analysis and use Laboratory	Practic al	1	-	2	30	20	50	-	08	20
FP	MIC42FPJ30 1	Field Project	Practic al	2		4	30	20	50	-	08	20
ME	MIC42MEP2 01	Seminar (Research Paper based)	Practic al	1	-	2	30	20	50	-	08	20
Total				22	13	18	420	280	700	-	112	280

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 Y	Year- Semes	ter VI										
Cour se Cate gory	Course Code	Course Title	Natur e of Cours e	No. of Cre dits	Tea (Co tł we	chin g ntac irs/ eek)	Evalu	ation Sc (Marks)	heme	Mini	mum Pa (Marks)	issing
					L	Р	Inte rnal	Exte rnal	Tota l	Inte rnal	Exte rnal	Tota l
MM	MIC42M ML304	Symbiosis, Plant Immunity and Disease	Lectur e	2	2	-	30	20	50	-	08	20
MM	MIC42M ML305	Industrial Microbiology	Lectur e	3	3	I	60	40	100	-	16	40
MM	MIC42M ML306	Gene Editing Technologies for Microbiology & therapeutic	Lectur e	3	3	I	60	40	100	-	16	40
ME	MIC42M EL202	Mycology	Lectur e	3	3	I	60	40	100	-	16	40
MI		Minor Course	Lectur e	3	3	-	60	40	100	-	16	40
OJT	MIC42JT P301	On Job Training	Practic al	4		8	60	40	100	-	16	40
MI		Minor Course	Practic al	1		2	30	20	50	-	08	20
MM	MIC42M MP302	Diagnosis and Industrial Microbiology Lab.	Practic al	1	-	2	30	20	50	-	08	20
MM	MIC42M MP <mark>303</mark>	Mini project	Practic al	1	-	2	30	20	50	-	08	20
ME	MIC42M EP202	Data analysis and statistics	Practic al	1	-	2	30	20	50	-	08	20
		Total		22	14	16	45 <mark>0</mark>	300	750	-	120	300

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 Y	ear- Semester V	II										
Course Catego ry	Course Code	Course Title	Natur e of Cours e	No. of Credi ts	Tea (Co th we	chin g ntac irs/ ek)	Eval	uation Sch (Marks)	eme	Mini	mum Pass (Marks)	ing
					L	Р	Intern al	Extern al	Total	Intern al	Extern al	Tot al
MM	MIC42MML 401	Biofertilizers	Lectur e	3	3	-	60	40	100	-	16	40
MM	MIC42MML 402	Analysis of gene expression	Lectur e	3	3	-	60	40	100	-	16	40
MM	MIC42MML 403	Microbiome	Lectur e	3	3	-	60	40	100	-	16	40
MM	MIC42MML 404	Biosafety, IPR and Bioethics	Lectur e	2	2	-	60	20	50	-	08	20
ME	MIC42MEL3 01	Bio- Protection	Lectur e	3	3	-	60	40	100	-	16	40
RM	MIC42RML4 01	Research Methodology I	Lectur e	3	3	-	60	40	100	-	16	40
RM	MIC42RMP4 01	Research Methodology II	Practi cal	1	-	2	30	20	50	-	08	20
ME	MIC42MEP3	R Programmin g	Practi cal	1	-	2	30	20	50		08	20
ММ	MIC42MMP 401	Microbial Engineering Laboratory	Practi cal	1	-	2	30	20	50		08	20
ММ	MIC42MMP 402	Major Project	Practi cal	1	-	2	30	20	50	-	08	20
MM	MIC42MMP 403	Bioferilizer lab	Practi cal	1	- 2		2 30 20		50	-	08	20
		Total=27		22	17	10	510	320	800	-	128	320

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 Y	'ear- Semester V	THI										
Course Catego ry	Course Code	Course Title	Natur e of Cour se	No. of Credi ts	Tea (Co th we	chin g ntac rs/ ek)	Evalu	ation Scho (Marks)	eme	Mini	mum Pass (Marks)	ing
					L	P	Intern al	Extern al	Tot al	Intern al	Extern al	Tot al
MM	MIC42MML 405	Systems Microbiology	Lectu re	3	3	-	60	40	100	-	16	40
MM	MIC42MML 406	Bacterial Genetics	Lectu re	3	3	-	60	40	100	-	16	40
MM	MIC42MML 407	Cosmetic Microbiology	Lectu re	3	3	-	60	40	100	-	16	40
MM	MIC42MML 408	Entrepreneurs hip microbiology	Lectu re	2	2	-	30	20	50	-	08	20
ME	MIC42MEL3 02	Microbial quality control	Lectu re	3	3	-	60	40	100	-	16	40
OJT	MIC42JTP4 01	On Job Training	Traini ng	4		8	60	40	100	-	16	40
ME	MIC42MEP 302	Microbial quality control lab	Practic al	1	-	2	30	20	50	-	08	20
MM	MIC42MMP 404	Practical Based on Research Methodology	Practic al	1	-	2	30	20	50	\mathbf{C}	08	20
MM	MIC42MMP 405	Big Idea	Practic al		-	2	30	20	50	\mathbf{D}	08	20
MM	MIC42MMP 406	Cosmetic microbiology lab	Practic al	1	-	2	30	20	50	-	08	20
		Total=30		22	14	16	450	300	750	-	120	300

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

MGM University Chhatrapati Sambhajinagar– 431003 (Template format as per discussion at 14/05/2023) Name of the College/Institute of Biosciences and Technology Name of the Program <u>(4 Years UG programme)</u>B.Sc. (Hons. Hons with Research) Microbiology

First Year First Year Teaching period	First Year Teaching period	First Year Teaching period Credits 1	First Year Teaching period Credits 1	First Year ing period Credits 1	First Year od Credits]	irst Year edits 1	1 1 1 1 1 1 1 1	· (Semester Duration	(I.	Ē	valuation	Scheme	e (Marks)			Minimu	um Passing	(Marks)	
Course code		Course Title	Type	iad (Hr	r week s /week)		-	of exam	Internal				Extern	al	H	Internal	Externa		E
				L	Т	Ч			CA-I	MSE	CA-II	T W	ESE	PR	10131	CA/MSE/TW	ESE	PR	10131
BMMML101		Biochemistry the building block of Life	Theory	5			5		10	10	10	ı	20	ı	50		08		20
BMMML102		Microbial Structure, Identification and Distribution	Theory	3		1	3		20	20	20	ı	40	1	100		16		40
		Annexure I	Theory	2			2		10	10	10	I	20	I	50		08	1	20
		Communicative English	Theory	2		-	5		10	10	10	ı	20	ı	50		80		20
BMOEL103	-	Open Elective I	Theory	7			2		10	10	10	1	20	ı	50		08		20
BMOEL104		Open Elective II	Theory	7		1	5		10	10	10	1	20	1	50		08		20
BMVSP105		Micro Lab I	Practical			4	5					30	ı	20	50			08	20
BMSEP106		Microbiology: Principle and Exploration-I	Practical			4	2					30	20	ı	50			08	20
		Annexure I	Theory	2			2		10	10	10	ı	20	I	50		08		20
BBMMP107		Micro building Block Lab	Practical		-	2	1					30	I	20	50			08	20
		Annexure I	Practical			4	2					30	-	20	50			80	20

 Total (L-T-P) Hrs / week = 29
 15
 14
 22

 Program Type: UG/PG/Integrated Masters Program/Diploma/Certificate - UG

Duration: - 04 Years (08 Semesters)

BMMML101

Biochemistry- The Building Blocks of Life

University: MGM University, Chh. Sambhajinagar Faculty: Basic and Applied Science

Institute: Institute of Biosciences and Tech. Degree: B.Sc. Microbiology (4yr. Hon./hons. With Res.)

Course Unit Code: BMMML101

Course Title: Biochemistry- The Building Blocks of Life

Credits allocated: (2 Theory+0 Practical) Level of Study: UG

Mode of delivery, planned learning activities and teaching method: Lecture 2 hrs / weekly

Recommended Year /Semester: Year I/ Semester I

Prerequisites for registration: Registration of a student in various courses in consultation with the respective course teacher and Adviser and acceptance by the principal. The approved courses must be mentioned in the roster form.

Course Objectives:

Develop in students the ability to apply the knowledge and skills they have acquired to the solution of specific theoretical and applied problems in biochemistry.

Objectives of studying Biomolecules and Bioenergetics, that is, to analyze, appreciate, understand the basic concepts of chemical reactions that occur in living systems, which enable them to understand the various perspectives of applied sciences that benefit mankind.

Course outcomes:

Demonstrate knowledge and understanding of the molecular machinery of living cells; demonstrate knowledge and understanding of the principles that govern the structures of

macromolecules and their participation in molecular recognition; demonstrate knowledge and understanding of the principles and basic mechanisms of

metabolic control and molecular signaling; use basic laboratory skills and apparatus to obtain reproducible data from biochemical experiments;

Detailed Syllabus: (30 Lectures)

Unit I: Biomolecules in their cellular environment (6 lecture)

The cellular basis of life. Cellular structures – prokaryotes and eukaryotes. Chemical principles in bio molecular structure. Major classes of biomolecules. Role of water in design of biomolecules.

Unit II: Bioenergetics: (8 lecture)

Thermodynamics –First law of thermodynamics, second law of thermodynamics, Gibbs free energy, endergonic & amp; exergonic reactions. Standard state free energy changes-DG, DG0 and DG'0, Relationship between equilibrium constant and DG'o, Feasibility of reactions. Simple problems, ATP-Structure, properties and energy currency of the cell, Introduction to Metabolism - Catabolism, anabolism, catabolic, anabolic and amphibolic pathways.

Unit III: Amino acids, peptides, Sugars and polysaccharides (8 lecture)

Types of amino acids and their chemistry, derivatives of amino acids and their biological role. Introduction to biologically important peptides. Basic chemistry of sugars, optical activity. Disaccharides, trisaccharides and polysaccharides- their distribution and biological role. Carbohydrate Metabolism: Introduction, Aerobic and anaerobic pathways: Glycolysis, TCA cycle, Electron Transport chain, Oxidative phosphorylation, & amp; production of ATP

Unit IV: Nucleosides, nucleotides and nucleic acids (8 lecture)

Structures and chemistry, DNA structures and their importance, different types of RNA. Unusual DNA structures, other functions of nucleotides.Amino Acid/ Nucleic Acid Various classes of lipids and their distribution, storage lipids, structural lipids in membranes, lipids as signals, cofactors and pigments. Occurrence and nutritional role. Lipid Metabolism: Beta – oxidations of saturated & amp; unsaturated fatty acids. Ketone bodies,production during starving and diabetes Biosynthesis of fatty acids.

Reference:

- Lehninger, Nelson and Cox, Principles of Biochemistry, 4th Edition, W.H. Freeman Company, 2004.
- Fundamentals of Biochemistry, Upgrade Edition, Wiley, 2002. 3. Lubert Stryer, Biochemistry, 4th Edition, W.H. Freeman

Text Book:

- 1. Prentice Hall Science: Test book, Prentice-Hall, Inc, Prentice Hall, 1993
- Building Blocks of Tabletop Game Design: An Encyclopedia of Mechanisms 1st Edition by Geoffrey Engelstein, Isaac Shalev

BMMML102 Microbial structure, identification, & Distribution

University: MGM University, Chh. Sambhajinagar Faculty: Basic and Applied Science
Institute: Institute of Biosciences and Tech.Degree: B.Sc. Microbiology (4yr Hon. /hons. With Res.)
Course Unit Code: BMMML102
Course Title: Microbial structure, identification, & Distribution
Credits allocated: 3 (3 Theory+0 Practical)
Level of Study: UG

Mode of delivery, planned learning activities and teaching method: Lecture 3 hrs / weekly **Recommended Year /Semester:** Year I/ Semester I

Prerequisites for registration: Registration of a student in various courses in consultation with the respective course teacher and Adviser and acceptance by the principal. The approved courses must be mentioned in the roster form.

Course Objectives:

To study the Basic concepts of microbiology & microorganisms.

Course Outcomes:

By the conclusion of this course, the students -

Have developed a good knowledge of the development of the discipline of Microbiology and the contributions made by prominent scientists in this field. Have developed a very good understanding of the characteristics of different types of microorganisms, methods to organize/classify these into and basic tools to study these in the laboratory. Are able to explain the useful and harmful activities of the microorganisms. Are able to perform basic experiments to grow and study microorganisms in the laboratory.

Detailed Syllabus: (45 lecture) Unit 1 Prokaryotic and Eukaryotic cell (07 lecture)

Prokaryotic and Eukaryotic cell differential account, Binomial nomenclature concept, Whittekar's five kingdom system, Carl woese's three kingdom system, Baltiomore classification.

Unit 2 General characters, Bacterial cell – organization and structure (11 lecture)

General characters of Bacteria, Fungi, algae, actinomycetes, mycoplasma, rickettsia, archaea, protozoa. Morphology of acellular microorganisms (Viruses, Viroids, Prions). Cell size, shape and arrangement, glycocalyx, capsule, flagella, endoflagella, fimbriae and pili. Difference between gram positive and gram-negative cell walls, Cell membrane, Ribosomes, mesosomes, chromosome, plasmids and endospore: structure and stages of sporulation. Archaebacterial cell wall and acid fast bacterial cell wall,

Unit 3 Methods of studying microorganism (11 lecture)

Methods of studying microorganism; Staining techniques: simple staining, Gram staining and acid-fast staining. Sterilization techniques (physical & chemical sterilization). Culture media & conditions for microbial growth. Growth curve of bacteria. Pure culture isolation: Streaking, serial dilution and plating methods. Maintenance and preservation of pure cultures.

Unit4 Identification and Bacterial diversity (08 lecture)

Classification of bacteria according to the Bergey's Manual of Systematic Bacteriology. Numerical taxonomy. Modern methods of studying bacterial diversity.

Unit 5 Role of microbes (08 lecture)

Role of microorganisms in different fields such as agriculture, human health, industry, food processing.

Reference

1. Prescott, M.J., Harley, J.P. and Klein, D.A. Microbiology. 5th Edition WCB Mc Graw

Hill, New York, (2002).

- Tortora, G.J., Funke, B.R. and Case, C.L. Microbiology: An Introduction. Pearson Education, Singapore, (2004).
- 3. Alcomo, I.E. Fundamentals of Microbiology. VI Edition, Jones and Bartlett

Publishers. Sudbury. Massachusetts, (2001).

- 4. Black J.G.Microbiology-Principles And Explorations.JohnWiley&SonsInc.NewYork, (2002).
- 5. Pelczar, MJ Chan ECS and Krieg NR, Microbiology McGraw-Hill.

Text Book:

- 1. Willey, Sherwood, Woolverton. Prescott, Harley, and Klein's Microbiology McGraw-Hill publication
- 2. Tortora, Funke, Case. Microbiology. Pearson Benjamin Cummings.
- 3. JACQUELYN G. BLACK. Microbiology Principles and explorations. JOHN WILEY & SONS, INC.
- 4. Madigan, Martinko, Bender, Buckley, Stahl.Brock Biology of Microorganisms. Pearson 10. Tom Besty, D.C Jim Koegh.Microbiology Demystified McGRAW-HILL

BMVSP105 Micro Lab-I

University: MGM University, AurangabadFaculty: Basic and AppliedScience Institute: Institute of Biosciences and Tech. Degree: B.Sc. Microbiology (4yrHon./hons. With Res.)Course Unit Code: BMVSP105Credits allocated: 0+2 (Practical)Level of Study: UG

Mode of delivery, planned learning activities and teaching method: Practical 4 hrs / weekly

Recommended Year /Semester: Year I/ Semester I

Prerequisites for registration: Registration of a student in various courses in consultation with the respective course teacher and Adviser and acceptance by the principal. The approved courses must be mentioned in the roster form.

Course Outcomes:

1. Students will be able to practice acquired knowledge within the chosen area of technology for project development.

2. Identify, discuss and justify the technical aspects of the chosen project with a comprehensive and systematic approach.

Thrust Area :

- **1.** Antimicrobial resistance
- **2.** Host Microbe interactions (Plants, Animals, Humans, etc)
- 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

• Ideas of Lab:

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.

• 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.

1.Implementation:

Follows closely the design, uses appropriate techniques with skill and understanding to produce a good solution.

2.Evaluation:

Clearly relates to the problem. Shows a good understanding and appreciation of the solution. Objectives of what has been done.

3.Lab 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

BMSEP106 Microbiology: Principle and Exploration-I

University: MGM University, Chh. Sambhajinagar Faculty: Basic and Applied Science

Institute: Institute of Biosciences and Tech. Degree: B.Sc. Microbiology (4yr Hon./hons. With Res.)

Course Unit Code: BMSEP106

Course Title: Microbiology: Principle and Exploration-I

Credits allocated: 2 (0 Theory+2 Practical) Level of Study: UG

Mode of delivery, planned learning activities and teaching method: Lecture 4 hrs / weekly

Recommended Year /Semester: Year I/ Semester I

Prerequisites for registration: Registration of a student in various courses in consultation with the respective course teacher and Adviser and acceptance by the principal. The approved courses must be mentioned in the roster form.

Course Objectives:

To introduce various microorganisms, present in the environment and acquaint with common equipment used in routine microbiology laboratory

Course Outcomes

As an outcome of completing the course, students will be able to gain knowledge about, Microorganism Understanding of Principles of microbiology. Identify multidisciplinary approaches required in solving a society problem. Understanding of commercial microbiology. Use the basics of science project management skills in doing projects. Demonstrate data analysis skills using a tool. Analyze microbial solutions from an ethical perspective.

Practical list:

1. To Study Various Instruments with its principle and application. (Autoclave, Laminar air flow chamber, Incubator, hot air oven, microscope, etc.)

- 2. To Study Aseptic Techniques in Lab.
- 3. To Study different types of glassware.
- 4. To prepare Bacterial media.
- 5. To prepare Fungal and actinomycetes media.
- 6. To isolation and enumeration of microorganisms from soil using serial dilution method.

- 7. To perform various plating methods
- 8. To perform streaking methods
- 9. Subculturing, broth cultures, maintenance of pure cultures.
- 10. To study storage and preservation techniques.
- 11. simple Staining technique for bacteria.
- 12. Slide culture technique for studying morphology of mold/fungi
- 13. Cover slip culture technique for preparing permeant fungi mount.
- 14. Microscopic examination of free-living protozoa from pond
- 15. Microscopic examination of algae/ cynobacteria.
- 16. Preparation of selective media for E. coli
- 17. To perform IMViC test
- 18. Preparation of selective media for Salmonella and Shigella.
- 19. Preparation of selective media for staphylococcus aureus
- 20. Demonstration of selective and diffential media.
- 21. To study the growth of Aspergillus Niger using onion peel
- 22. Isolation of *Rhizobium* species.
- 23. Isolation of cyanobacteria
- 24. To study a research paper.

BBMMP107 Micro Building Block lab

University: MGM University, Aurangabad Faculty: Basic and Applied Science

Institute: Institute of Biosciences and Tech. Degree: B.Sc. Microbiology (4yr. Hon./hons. With Res.)

Course Unit Code: BBMMP107 Course Unit Title: Micro building Block lab

Credits allocated: 1 (0 Theory +2 Practical) Level of Study: UG

Mode of delivery, planned learning activities and teaching method:

Recommended Year /Semester: Year 1/ Semester I

Subject Name: Micro building Block lab

Prerequisites for registration: Registration of a student in various courses in consultation with the respective course teacher and Adviser and acceptance by the principal. The approved courses must be mentioned in the roster form.

Course Objectives:

To provide overview of biology of microorganisms

To develop the understanding of microbial taxonomy and introduction to

diversity To understand and perform the techniques of micro lab.

Course outcome:

To understand the biology of bacteria Understanding of basic concepts of microbiology lab An overview of physical and chemical methods in microbiology Mode of Teaching: Practical

Practical List:

- 1. of bacteria from soil/water/Air using serial dilution method.
- 2. Isolation and enumeration fungi from soil/water/Air using serial dilution method.
- 3. Counting of bacterial population by the use of spectrophotometer.
- 4. To study morphology of fungi and microscopic study
- 5. To study gram staining
- 6. To study acid fast staining
- 7. To study endospore staining
- 8. To study cell wall staining

- 9. To study capsule staining
- 10. To study motility of bacteria using hanging drop technique.
- 11. Growth curve of bacteria
- 12. To perform yeast demonstration using sugar
- 13. Physical agent of control: moist heat, dry heat and UV radiations
- 14. Chemical agents of control: evaluations of anticeptics/alcohol/
- 15. Chemical agents of control: evaluations of disinfectants (Phenol Coefficient)
- 16. To perform Benedict's test for carbohydrate
- 17. To perform a Biuret test for protein.
- 18. To study lawry's test for protein.
- 19. To perform Fehling's test for Carbohydrate.
- 20. Study research Paper

Reference:

- 1. Microbiology laboratory manual second edition revised pattern by gayne Bablanian Jainine Payne.
- 2. Microbiological edition practical edition by Amita Jain.

1			-				-						-	
	Loto		20	40	20	20	20	20	20	20	20	20	20	
asing	_	PR							08	08		80	80	
nimum Ps	External	ESE	08	16	08	08	08	08			08			
Mi	Internal	CA/MSE/T W												
	Totol T	1 0141	50	100	50	50	50	50	50	50	50	50	50	
	_	PR					-		20	20		20	20	
neme	Externa	ESE	20	40	20	20	20	20	ı		20	-	-	
Valuation Scl		ML		-	-	-	-	-	30	30	-	30	30	
-	nternal	CA-II	10	20	10	10	10	10			10			
		MSE	10	20	10	10	10	10			10			
		CA-I	10	20	10	10	10	10			10			
Dur atio	n of exa m													
di Cr			2	ŝ	2	2	2	2	2	2	2	1	2	22
hariod	sek	Ч		1	•	1	'		4	4	•	2	4	14
aachina	perw	T	0			-] 3	5	2				•	•	
		L												15
	Type	1	Theory	Theory	Theory	Theory	Theory	Theory	Practical	Practical	Theory	Practical	Practical	
	Course Title		Microbial Physiology and Metabolism	Biology: Concept, Connections, Investigation and applications	Annexure I	Communicative English II	Open Elective I	Open Elective II	Annexure I	Micro Lab II	Explorations in Microbiology -I	Bio-Skills Sets Laboratory-I	Annexure I	
	Course code		BMMML108	BMMML109	BMMIL110		BMOEL111	BMOEL112		BMVSP114	BMSEL1115	BBMMP116		
Course			Core	Core	NIN	AEC	0E**	OE	VEC*	VSC*	SEC*	Core	cc	
Level							4.5							

BMMML108 Microbial Physiology and Metabolism

University: MGM University, Aurangabad Faculty: Basic and Applied Science

Institute: Institute of Biosciences and Tech. Degree: B.Sc. (Hons) Microbiology

Course Unit Code: BMMML108

Course Unit Title: Microbial Physiology and Metabolism

Credits allocated: 2 (2 Theory+0 Practical) Level of Study: UG

Mode of delivery, planned learning activities and teaching method: Lecture 2 hrs / weekly

Recommended Year /Semester: Year I/ Semester II

Prerequisites for registration: Registration of a student in various courses in consultation with the respective course teacher and Adviser and acceptance by the principal. The approved courses must be mentioned in the roster form.

Course Objectives:

To study the concepts of Physiology of microbes and their metabolism

Course Outcomes:

Students have developed a good knowledge of the development of the discipline of Microbiology and the contributions made by prominent scientists in this field. Have developed a very good understanding of the characteristics of physiology of microbes, environment factors which affect growth of microbes, respiration and photosynthesis.

Detail Syllabus (30 lecture)

Unit I: Microbial Growth and Effect of Environment on Microbial Growth (8 lecture) Definitions of growth, measurement of microbial growth, Batch culture, Continuous culture, generation time and specific growth rate, synchronous growth, diauxic growth curve Microbial growth in response to environment –Temperature (psychrophiles, mesophiles, thermophiles, extremophiles, thermodurics, psychrotrophs), pH (acidophiles, alkaliphiles), solute and water activity (halophiles, xerophiles, osmophilic), Oxygen (aerobic, anaerobic, microaerophilic, facultative aerobe, facultative anaerobe), barophilic. Microbial growth in nutrition Autotroph/Phototroph, response to and energy heterotrophy, Chemolithoautotroph, Chemolithoheterotroph, Chemoheterotroph, Chemolithotroph, photolithoautotroph, Photoorganoheterotroph.

Unit II: Nutrient uptake and Transport (5 lecture)

Passive and facilitated diffusion Primary and secondary active transport, concept of uniport, symport and antiport, Group translocation.

Unit III: Chemo heterotrophic Metabolism – Aerobic Respiration (7 lecture)

Concept of aerobic respiration. EMP, ED, Pentose phosphate pathway, TCA cycle, Electron transport chain: components of respiratory chain, comparison of mitochondrial and bacterial ETC.

Unit IV: Chemoheterotrophic Metabolism- Anaerobic respiration and fermentation (10 lecture)

Anaerobic respiration with special reference to dissimilatory nitrate reduction (Denitrification; nitrate /nitrite and nitrate/ammonia respiration; fermentative nitrate reduction); Fermentation - Alcohol fermentation. Lactate fermentation (homofermentative and heterofermentative pathways). Introduction to phototrophic metabolism: an Overview - groups of phototrophic microorganisms, anoxygenic vs. oxygenic photosynthesis with reference to photosynthesis in green bacteria, purple bacteria and cyanobacteria. Nitrogen metabolism an overview.

Reference Books:

- Madigan MT, and Martinko JM (2014). Brock Biology of Microorganisms. 14th edition. Prentice Hall International Inc.
- 2. Moat AG and Foster JW. (2002). Microbial Physiology. 4th edition. John Wiley & Sons
- Stanier RY, Ingram JI, Wheelis ML and Painter PR. (1987). General Microbiology. 5th edition, MacMillan Press.
- Madigan MT, and Martinko JM (2014). Brock Biology of Microorganisms. 14th edition Prentice Hall International Inc.
- Moat AG and Foster JW. (2002). Microbial Physiology. 4th edition. John Wiley &Sons
- 6. Moat AG and Foster JW. (2002). Microbial Physiology. 4th edition. John Wiley & Sons
- 7. Gottschalk G. (1986). Bacterial Metabolism. 2nd edition. Springer Verlag.
- Willey JM, Sherwood LM, and Woolverton CJ. (2013). Prescott's Microbiology. 9th edition. McGraw Hill Higher Education

Text Book:

- Reddy SR and Reddy SM. (2005). Microbial Physiology. Scientific Publishers India Gottschalk G. (1986). Bacterial Metabolism. 2nd edition. Springer Verlag.
- 2. Reddy SR and Reddy SM. (2005). Microbial Physiology. Scientific Publishers India

BMMML109 Biology Concept and Connection Investigation and Application

University: MGM University, Aurangabad	Faculty: Basic and Applied Science
Institute: Institute of Biosciences and Tech. Course Unit Code: BMMML109	Degree B.Sc (Hons) Microbiology

Course title: Biology Concept, Connection Investigation and Application Credits allocated: 3 (3 Theory+0 Practical) Level of Study: UG

Mode of delivery, planned learning activities and teaching method: Lecture 3 hrs / weekly

Recommended Year /Semester: Microbiology, Year I/ Semester II **Prerequisites for registration:** Registration of a student in various courses in consultation with the respective course teacher and Adviser and acceptance by the principal. The approved courses must be mentioned in the roster form.

Course Objectives:

To familiarize students with the Biology concept. structure of genetic material, organization of genes, genetic code and mechanisms involved in the expression of genetic material in final functional form.

Course outcome

Students will acquire knowledge about biology concept Detail Syllabus: (45 Lectures)

UNIT 1 Eukaryotic and prokaryotic cell (9 lecture)

Eukaryotic and prokaryotic cell, organelle structure and functions, Integrated cellular functions,

Apoptosis and natural cell death.

Brief account on plant and animal cells. Viruses - structure and features, types of viruses

Building blocks of cell

CARBOHYDRATES- nomenclature, structure and functions, monosaccharides, disaccharides, polysaccharides, homopolysaccharides, hetero polysaccharides, Glycoproteins

LIPIDS- Classification and functions; Fatty Acids- even-odd, saturated and unsaturated, length, nomenclature, TAGs, Phospholipids, Steroids, lipoprotein, Cholesterol; Amphipathic lipids, Soaps and detergents.

UNIT 2 Nucleic Acid

NUCLEIC ACID- Nucleotides, structure and nomenclature, DNA structure, different forms of DNA, measurement units. Denaturation, Tm value, melting point and renaturation.

Structure of RNA and its types, role of different RNA, Ribozymes.

UNIT 3 PROTEINS- functions & its chemical nature

PROTEINS- functions chemical nature; Amino acid structure and properties, peptide bond, Levels of protein structure- primary, secondary (alpha helix and beta structures), tertiary and quaternary structure. Other bonds in protein structure, examples. Properties of proteins and their classification, Protein denaturation, Determination of protein structure, Isolation and purification of proteins.

UNIT 4 Enzymes

ENZYMES- Historical events in discovery, nomenclature and classification, properties, Enzyme activity, Factors affecting enzyme activity like concentration of substrate or enzyme or product, temperature, pH, Active center of enzymes, Enzyme inhibition, Coenzymes, Enzyme action.

UNIT 5 Techniques in RDT

TECHNIQUES in RDT, DNA isolation, RNA isolation, Protein isolation, gel electrophoresis, **Reference Books-**

- 1. Biology: Concepts and Investigations, Mariëlle Hoefnagels, 2, illustrated
- 2. Biology: Concepts and Applications 10th Edition by Cecie Starr, Christine Evers, Lisa Starr

Text Book:

- 1. Biology: Concepts and Applications, Cecie Starr, Christine Evers, Lisa Star
- 2. Biology Concepts And Investigations, Mariëlle Hoefnagels: McGraw-Hill Europe

(9 lecture)

(9 lecture)

(9 lecture)

(9 lecture)

BMVSP114

Micro Lab-II

University: MGM University, Aurangabad

Faculty: Basic and Applied Science **Degree:** B. Sc (4 year Hons/Hons.

Institute : Institute of Biosciences and Tech.

With res.) Microbiology

Course Unit Code: BMVSP114

Course Unit Title : Micro Lab-II

Credits allocated : (0 Theory+ 4 Practical)Level of Study : UG RecommendedYear /Semester : Microbiology , Year I/ Semester II

Prerequisites for registration: Registration of a student in various courses in consultation with the respective course teacher and Adviser and acceptance by the principal. The approved courses must be mentioned in the roster form.

Thrust Area:

- 1. Antimicrobial resistance
- 2. Host Microbe interactions (Plants, Animals, Humans, etc)
- 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

Ideas of lab:

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.

• 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.

1. Implementation:

Follows closely the design, uses appropriate techniques with skill and understanding to produce a good solution.

2. Evaluation:

Clearly relates to the problem. Shows a good understanding and appreciation of the solution. Objectives of what has been done.

3. lab 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

BMSELI115

Explorations in Microbiology -I

University: MGM University, Aurangabad Faculty: Basic and Applied Science

Institute: Institute of Biosciences and Tech. Degree: B.Sc (4 year Hons./Hons. With res.) Microbiology

Course Unit Code: BMSEL1115

Course Title: Explorations in Microbiology -I

Credits allocated: 2 (2 Theory & Practical) Level of Study : UG

Mode of delivery, planned learning activities and teaching method: Lecture 4 hrs / weekly

Recommended Year /Semester: Microbiology, Year I/ Semester II

Prerequisites for registration: Registration of a student in various courses in consultation with the respective course teacher and Adviser and acceptance by the principal. The approved courses must be mentioned in the roster form.

Course Objectives:

To introduce various microorganisms present in the environment and acquaint with common equipment used in routine microbiology laboratory.

Course outcomes:

By the conclusion of this course, the students -

Have developed a very good understanding of the characteristics of different types of microorganisms, methods to organize/classify these into and basic tools to study these in the laboratory. Are able to explain the useful and harmful activities of the microorganisms.. Are able to perform basic experiments to grow and study microorganisms in the

Practical list:

- 1. Isolation of Microorganism from soil.
- 2. Preservation of microbes.
- 3. Growth of microorganisms on various carbon sources.
- 4. Growth of microorganisms on various nitrogen sources.
- 5. Determination of growth rate of microorganisms.
- 6. Effect of pH on the growth of microorganisms.
- 7. Effect of temperature on the growth of microorganisms.
- 8. Effect of osmotic pressure on the growth of microorganisms.
- 9. Studies on aerobic respiration with suitable substrates.
- 10. Studies on anaerobic respiration with suitable substrates.
- 11. Studies on growth regulation by chemicals.
- 12. Studies on bacterial photosysnthesis.
- 13. Nitogen fixation
- 14. Studies on enzyme induction/assay in microorganisms.
- 15. Influence of metabolic intermediates on microbial growth and function.
- 16. Studies on different factors affecting growth and secondary metabolite production in microorganisms.
- 17. Use of P sources for studying P uptake by microorganisms.
- 18. Use of K sources for studying K uptake by microorganisms
- 19. Lethal effect of temperature on micro-organism(TDP)
- 20. Lethal effect of temperature on micro-organism(TDT)
- 21. Effect of Ph on micro-organism.
- 22. Effect of salt concentration
- 23. To study the protein hydrolysis test.
- 24. To study a research paper.

References:

- Atlas, R. M. (1997) Principles of Microbiology, 2nd edition, W.M.T.Brown Publishers, Dubuque, USA.
- Cappuccino J and Sherman N. (2010) Microbiology: A Laboratory Manual, 9th edition, Pearson Education Limited, New Delhi
- Parija S.C. (2005) Text Book of Practical Microbiology, 1st edition, Ahuja Publishing House, New Delhi.
- 4) Dubey RC and Maheshwari DK (2004) Practical Microbiology, 1st edition, S. Chand and Co., Delhi.
- 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, 8th edition, The McGrawHill Companies, New York
- Aneja K.R. (1996) Experiments in Microbiology, 3rd edition, WishwaPrakashan, New Delhi.

BBMMP116 Bio Skill Set Laboratory-I

University: MGM University, Aurangabad	Faculty: Basic and Applied Science
Institute: Institute of Biosciences and Tech. Microbiology	Degree: B. Sc (4 year Hons./ hons. With res.)
Course Unit Code: BBMMP116	Course Title: Bio-skill Sets laboratory
Credits allocated: 1 (0 Theory+2 Practical)	Level of Study: UG

Mode of delivery, planned learning activities and teaching method: 2 hr/week

Recommended Year /Semester:

Microbiology, Year 1/ Semester II

Prerequisites for registration: Registration of a student in various courses in consultation with the respective course teacher and Adviser and acceptance by the principal. The approved courses must be mentioned in the roster form.

Course Objectives:

To equip students with basic skills required for carrying out experiments in biology laboratories.

Course outcomes:

Students should understand the importance of safety while working in a laboratory. Be familiar with handling of chemicals, Understand principles and proper handling of analytical instruments. Be comfortable with basic procedures required for carrying out experiments . Mode of Teaching: Laboratory exercises

Detailed Syllabus:

Practical's:

- 1. Study of Eukaryotic and Prokaryotic cells
- 2. To Study different phases of stages by using slides.
- 3. Isolation of protein
- 4. Isolation of human microflora from skin.
- 5. Separation of dyes by gel electrophoresis method.
- 6. To determine the surface tension of the given liquid using stalagmometer
- 7. Qualitative test for carbohydrates.

- 8. Estimation of reducing sugar by Sumner's method.
- 9. Blood staining
- 10. RA detection.
- 11. To study widal test detection of typhoid.
- 12. To study Biodegradable waste
- 13. To study non-Biodegradable waste
- 14. To observe the epidermal cell from onion.
- 15. To observe the stomatal cell from leaves.
- 16. Isolation of Enzyme
- 17. Effect of temperature on enzyme
- 18. Effect of ph on enzyme
- 19. To study Thin layer chromatography
- 20. To study Paper Chromatography
- 21. To Study a Research paper.

Reference:

- 1. Jurg P. Seiler, Good laboratory practices-why and how, Springer
- 2. WHO, Laboratory Biosafety Manual,

Text Book:

- 1. WHO, Good Laboratory practice handbook
- 2. Wilson and Walker, Principles and Techniques of Biochemistry and Molecular Biology, Cambridge

Syllabus <u>Semester-III</u>

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, polyadenylation, 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 l	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: 2	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, uncoating, 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.
1	Principles of Basteriology, Virology and Immunology, Topley Wilson 1995

4. Principles of Bacteriology, Virology and Immunology, Topley Wilson 1995.

5Applied 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.		

MGMUNIVERSITY

Course code: MIC42MML203Course name: Microbial Fermentation Course category:Major Mandatory

Credits: 2 **Teaching scheme:** L-2 ESE–20

Evaluation scheme: CA-30,

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 ESE–20

Evaluation scheme: CA-30,

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: MIC42MMP201Course name: Fermentation Technology LaboratoryCourse 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 <i>A.niger</i> from onion
7.	To study Antibiotic assay
8.	To study preservation techniques
9.	Identification of <i>A.niger</i> 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 <i>Pseudomonas</i>
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

Refer	ence 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:MIC42FPJ201Course name: Field ProjectCourse category: FieldProject

Credits: 2 **Teaching scheme:** P-4 ESE–20

Evaluation scheme: CA-30,

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.

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.

	Performance:					
3	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.					
	Implementation:					
4	Follows closely the design, uses appropriate techniques with skill and understanding to					
	produce a good solution.					
	Evaluation:					
5	Clearly relates to the problem. Shows a good understanding and appreciation of the					
	solution. Objectives of what has been done.					
	Project Log:					
	a. The individual student's effort and commitment.					
6	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 & amp; time to time signature of guide					
	Thrust Area					
	1. Antimicrobial resistance					
	2. Host Microbe interactions (Plants, Animals, Humans,)					
	3. Microbial genomics					
	4. Microbial analysis					
7	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.	Activities	Responsibilities
No.		
1	PG students are deciding on their team members for their semester	Project head, PG
	project with their proposed project domain and title	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 guide Project
	project guides.	head
4	Synopsis preparation and submission	Project head

MGMUNIVERSITY

5	Verification of student project log book	Project guide Project
		head
6	Approval of PPT: Abstract, existing, proposed system. 30% of	Project guide
	proposed work.	
	80% of proposed work. 100% of proposed	
	work.	
7	Preparation and submission of progress report during project	Students Project head
8	Preparing list for Redo students (insufficient content, plagiarism,	Project head
	poor presentation, genuine absentees.	
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	Project head Project
	before the specified deadline , he/she is deemed to have failed in	guide Director
	the project work and shall re – enroll for the same	

MGMUNIVERSITY

Second Year- Semester IV												
Course Catego ry	Course Code	Course Title	Nature of Course	No. of Cred	Teachi ng (Cont act Hrs/ week)		Evaluation Scheme (Marks)			Minimum Passing (Marks)		
					L	Р	Intern al	Exter nal	Tot al	Inter nal	Exter nal	Tot al
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	MIC42SEP20 1	Infection control Lab	Practica 1	2		4	30	20	50	-	08	20
MI		Minor Course	Practica	1	-	2	30	20	50	-	08	20
MM	MIC42MMP 202	Advance Fermentation Laboratory	Practica 1		1	2	30	20	50		08	20
CEP	MIC42CEJ20 1	Community Engagement and Service (Field project)	Project	2		4	30	20	50		08	20
СС	MGM73CCP 105	Fine Arts	Practica 1	2		4	30	20	50	-	08	20
Total 30)			22	1 4	1 6	390	260	650	-	104	260

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: MIC42MML204Course name: Genome Maintenance and RegulationCourse 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			
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

The student should have basic knowledge of biological and applied **Pre-requisites:** 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				
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			

٦

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

I EXI BOOKS:

1	CAL L	JUURS.				
	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.				
R	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: MIC42MML206Course name: Molecular Basis of Bacterial InfectionCourse 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				
Omi	Content				
	Skin and Mucosa:				
	The First Lines of defence against Bacterial Infections				
	Mechanism of bacterial infection, types of bacterial infection, virulence				
1	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.				
	Overview of the Human Micro biota				
	Definition of microbiota, Different types of microorganisms present in the				
2	human body (bacteria, viruses, fungi, etc.) Roles of microbiota in digestion	0			
2	and nutrient absorption.Skin Micro biota, Oropharyngeal Microbiota,	8			
	Microbiota of the Small Intestine and Colon, Microbiota of the Vaginal				
	Tract, Probiotics, prebiotics, and synbiotics.				

	Gram-Positive Opportunistic Pathogens					
	Brief overview of Gram-positive bacteria and their characteristics. Definition					
2	and characteristics of opportunistic pathogens. Clinical significance of					
3	Gram-positive opportunistic pathogens (e.g., Staphylococcus aureus,					
	Enterococcus spp., Streptococcus spp.) Mechanisms of pathogenesis					
	employed by Gram-positive opportunistic pathogens.					
	Gram-Negative Opportunistic Pathogens					
	Introduction to Gram negative bacteria. Structural components unique to					
4	Gram-negative bacteria (outer membrane, lipopolysaccharide layer, etc.)	7				
4	Pseudomonas, Escherichia coli, Klebsiella, Acinetobacter, etc.) Mechanisms	1				
	by which Gram-negative pathogens cause disease (endotoxins, exotoxins,					
	adhesion molecules, etc.					

T 4 D 1

I e	XT E	sooks:
	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
Re	fere	ence 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, 5 th
	edition, The McGraw-Hill Co., New York

	5.	Benson	H. (2	2001)	Microbiological	Applications	Lab	Manual,	8	th	edition,	The
		McGrawl	Hill C	Compa	nies, New York							
(6.	Aneja K.	R. (19	996) E	xperiments in Mi	crobiology, 3r	d edit	ion, Wish	wa	Pra	kashan, N	lew

MGMUNIVERSITY

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. Literature survey:
2	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.
	Performance:
3	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
	Implementation:
4	Follows closely the design, uses appropriate techniques with skill and understanding to produce a good solution
	Evaluation:
5	Clearly relates to the problem. Shows a good understanding and
	appreciation of the solution. Objectives of what has been done.
	Project Log:
	a. The individual student's effort and commitment.
6	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 & amp; time to time signature of guide
	Thrust Area
	1. Antimicrobial resistance
	2. Host Microbe interactions (Plants, Animals, Humans)
	3. Microbial genomics
	4. Bioremediation
7	5. Microbial ecology 6. Bioprosposting (Biofuel Diefertilizer etc.)
	6. Bioprospecting (Biofuel, Biofertilizer, etc)
	7. Where μ is the participation of μ is the participa
	9 Synthetic biology
	10. Cyanobacterial and algal hiotechnology
	io. Cyanobacteriai and aigai bioteennology

Sr.	Activities	Responsibilities
No.		
1.	PG students are deciding on their team members for their	Project head, UG students
	semester project with their proposed project domain and	
	title	
2.	Director shall allocate the project guide based on their area	Director
	of expertise (ot more than 3 batches to a guide)	
3.	Ensuring that students have regular discussion meetings	Project guide Project head
	with their project guides.	
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%	Project guide
0.	of proposed work	
	80% of proposed work, 100% of proposed work.	
7.	Preparation and submission of progress report during	Students Project
	project	head
8.	Preparing list for Redo students (insufficient content,	Project head
	plagiarism, poor presentation, genuine absentees.	
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	Project head Project guide
	on or before the specified deadline , he/she is deemed to	Director
	have failed in the project work and shall re – enrol for the	

PROCEDURE

same