Shiv Chhatrapati Shikshan Sanstha's

Rajarshi Shahu Mahavidyalaya, Latur

(Autonomous)



Structure and Curriculum of Four Year Multidisciplinary Degree (Honors/Research) Programme with Multiple Entry and Exit option

Undergraduate Pr<mark>ogramme of Scienc</mark>e and Technology B.Sc. (Honors/Research) in Microbiology

Board of Studies

in Microbiology Rajarshi Shahu Mahavidyalaya, Latur

(Autonomous)

Rajarshi Shahu Mahavidyalaya,

w.e.f. June, 2023 (In Accordance with NEP-2020)

Review Statement

The NEP Cell reviewed the Curriculum of **B.Sc. (Honors/Research) in Microbiology** Programme to be effective from the **Academic Year 2023-24.** It was found that, the structure is as per the NEP-2020 guidelines of Govt. of Maharashtra.

Date: 09/08/2023

Place: Latur

NEP CELL Rajarshi Shahu Mahavidyalaya, Latur (Autonomous)

व छत्रपत

ण संस्था

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CERTIFICATE

I hereby certify that the documents attached are the Bonafide copies of the Curriculum of **B.Sc. (Honors/Research) in Microbiology** Programme to be effective from the **Academic Year 2023-24**.

Date: 14-07-2023 Place: Latur

(Dr. K.G. Maske) Chairperson Board of Studies in Microbiology Rajarshi Shahu Mahavidyalaya, Latur (Autonomous)

संस्था

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(Autonomous) Members of Board of Studies in the Subject Microbiology Under the Faculty of Science and Technology

Sr. No.	Name	Designation	In position
1	Dr.K.G.Maske	Chairperson	HoD
	Head, Department of Microbiology,	÷	
	Rajarshi Shahu Mahavidyalaya, Latur	•	
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2	Dr. B. S.Nagoba	Member	V.C. Nominee
	Assistant Dean (R D), Professor of		
	Microbiology, MIMSR Medical College <mark>, Latur-</mark>		
	413 512 (MS), India		
3	Dr. Ulhas K. Patil	Member	Academic Council Nominee
	Government Institute of Science Aurangabad		
4	Dr A. M. Deshmukh	<u>Member</u>	Academic Council Nominee
	Former Professor and President,		
L	Microbiologist Society of India	Manahan	Free art frame antai da fare fra acial
5	Dr. Manmonan Bajaj Product Manager, BIOCENE INDIA	Member	Expert from outside for Special
	New Delhi		Course
6	Dr.Vinodkumar Patil	Member	Expert from Industry
	Director, Dyna Biotech 9 <mark>8/A5,Hadapsar</mark>		
	Industrial Estate Bhd. Kirloskar Pneumatic		
7	Co., Hadapsar, Pune	Mombor	P.C. Alumni
/	Sr Scientist Division of Biochemical	Member	P.G. Alulilli
	Sciences Dr. Homi Babha Road Pashan NCL		
	Pune	form re	
-		राव छ	אימו
8	Dr.D.V.Vedpathak	Member	Faculty Member
9	Dr.K.I.Momin	Member	Member from same Faculty

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From the Desk of the Chairperson...

The National Education Policy lays particular emphasis on the development of the creative potential of each individual. NEP-2020 has conceptualized the idea to develop well rounded competent individuals for making the nation a self-reliant and global leader.

Department of Microbiology has developed a curriculum framework to encompass the goals of NEP 2020. Microbiology is study of microorganisms such as bacteria, protozoa, algae, fungi, viruses, etc. These studies integrate cytology, physiology, ecology, genetics and molecular biology, evolution, taxonomy and systematics with a focus on microorganisms. It is one of the significant branches of sciences to understand the principles of life which has roots in the study of various microbial systems. Microbiology has been at the forefront of research in industry, environment, agriculture, food, dairy, medicine and biology. It is one of the rapidly growing and applied areas of the science. Many job opportunities available for student in this stream. Trained manpower is required in industrial production of microbial products. Considering rural and agro based life background and awareness about the general health and hygiene , our curriculum is designed to educate our students in various important microbiological domains, as well as to promote and develop skills and competencies that have great value.

> (**Dr. K. G. Maske)** Chairperson Board of Studies in Microbiology



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Faculty of Science and Technology

Structure for Four Year Multidisciplinary Undergraduate Degree Programme in Microbiology Multiple Entry and Exit (In accordance with NEP-2020)

Year		Maj	or			VSC /			Credi	
&	Sem	DCC	DCD	Mino	GE/OE	SEC	AEC/	OJT,FP,CEP,	t per	Cum./Cr.
l		DSC	DSE	Г		(VSEC)	VEC	KP	Sem.	per exit
1	2	3		4	5	6	7	8	9	10
	Ι	DSC I:	NA	NA	G <mark>E-I:</mark>	VSC-I:	AEC-I	CC-I: 02 Cr.	22	
		04 Cr.			0 <mark>4 Cr.</mark>	<mark>02</mark> Cr.	MIL:	(NSS, NCC,		
		DSC II:				SEC-I:	02 Cr.	Sports,		
		04 Cr.				02 Cr.	VEC-I:	Cultural)/		
							<mark>02 C</mark> r.	CEP-I: 02 Cr.		
								(SES-I)/		
								0JT: 02 Cr. /		44 Cr
								Mini		
				(Project: 02		Cortifica
Ι								Cr.		to
4.5	II	DSC III:	NA	NA	GE-II:	VSC-II:	AEC-II	Generic IKS:	22	le
		04 Cr.		•	04 Cr.	02 Cr.	MIL:	02 Cr.		
		DSC IV:				SEC-II:	02 Cr.	6		
		04 Cr.				02 Cr.	VEC-	त्रपती		
						for	II: 02	inour		
						<u>।</u> रा	Cr.	सस्य।		
						C	तूर			
	Cum.	16	-		08	04+04	04+02	04	44	
	Cr.		113	121	इ लब	= 08	+02=0	T: 11		
							8			
Exit	Option:	Awa <mark>rd o</mark> f	UG Cert	ificate in	Major w	it <mark>h 44 Cre</mark>	dits and A	Additional 04 Cr	edits Co	re NSQF
			Course,	/Interns	hip or cor	ntinue wit	h Major a	nd Minor		

Abbreviations:

- 1. DSC : Discipline Specific Core (Major)
- 2. DSE : Discipline Specific Elective (Major)
- 3. DSM : Discipline Specific Minor
- 4. GE/OE : Generic/Open Elective
- 5. VSEC : Vocational Skill and Skill Enhancement Course
- 6. VSC : Vocational Skill Courses
- 7. SEC : Skill Enhancement Course
- 8. AEC : Ability Enhancement Course
- 9. MIL : Modern Indian Lang<mark>uages</mark>
- 10. IKS : Indian Knowledge System
- 11. FSRCE : Fostering Social Responsibility & Community Engagement
- 12. VEC : Value Education Courses
- 13. OJT : On Job Training
- 14. FP : Field Projects
- 15. CEP : Community Engagement and Service
- 16. CC : Co-Curricular Courses
- 17. RP : Research Project/Dissertation
- 18. SES : Shahu Extension Services

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Department of Microbiology B.Sc. (Honors/Research) Microbiology

Year & Level	Semester	Course Code	Course Title	Credits	No. of Hrs.
		101MIB1101 (DSC-I)	Introductory Microbiology	03	45
		101MIB1103	Lab Course-I	01	30
		101MIB1102	Methods in Microbiology	03	45
		(DSC-II)			
		101MIB110 <mark>4</mark>	Lab Course-II	01	30
	Ι	GE-I	From Basket	04	60
		101MIB1501	Food Fermentation	02	45
		(VSC-I)	Technology		
		(SEC-I)	From Basket	02	30
		(<mark>AEC</mark> -I)	From Basket	02	30
		(VEC-I)	Constitution of India	02	30
		AIPC/OJT-I	Field Project	02	60
I		Total Cre	edits	22	
4.5		101MIB2101	Basics of Microbiology	03	45
		(DSC-III)	and Biomolecules		
		101MIB2103	Lab Course-III	01	30
		101MIB2102	Microbial Nutrition	03	45
		(DSC-IV)	ाराव छत्रप		
		101MIB2104	Lab Course-IV	01	30
	II	GE-II	From Basket	04	60
		101MIB2502	Bio pesticide production	02	45
		(VSC-II)			
		(SEC-II)	From Basket	02	30
		(AEC-II)	From Basket	02	30
		(VEC-II)	FSRCE (CBPR)	02	30
		Generic IKS	Introduction to Indian Knowledge System	02	60
		Total Cre	dits	22	
	Total C	Credits (Semeste	r I & II)	4	4



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Faculty of Science & Technology After the completion of the B.Sc. programme, a student will have obtained:

	Programme Outcomes (POs) for B.Sc. Programme			
After the com	pletion of the B.Sc. programme, a student will have obtained:			
PO 1	Disciplinary Knowled <mark>ge</mark>			
	Comprehensive knowledge of science subjects which constitute the graduate programme and execution of scientific knowledge in the specific area.			
PO 2	Scientific Outlook			
	The qualities of a science graduate such as observation, precision, analytical mind, logical thinking, clarity of thought and expression and systematic approach.			
PO 3	Self-Directed Life-long Learning			
	Ability to appear for various competitive examinations or choose the post graduate programme or other related programme of their choice.			
PO 4	Research Skills			
	Functional knowledge and applications of instrumentation and laboratory techniques to do independent experiments, interpret the results and develop research ethos.			
PO 5	Problem Solving Skills [응답이 관문]			
	Analytical and logical skills and critical thinking to extract information from qualitative and quantitative data, formulate and solve problems in a systematic and rational manner.			
PO 6	Professional Competence and Ethics			
	Aptitude and skills to perform the jobs in diverse fields such as science, engineering, industries, survey, education, banking, development and planning, business, public service, self-business etc. with human rationale and moral values.			



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Programm	e Specific Outcomes (PSOs) for B.Sc. Microbiology (Honors/Research)
PSO No.	Upon completion of this programme the students will be able to
PSO 1	Academic Competence
	Comprehensive knowledge in the underlying principles of Microbiology, basics in Microbiology and Biomolecules, Methods, Microbial nutrition and growth, fundamentals of immunology, Environmental Microbiology, Production of Biofertilizer, Agricultural Microbiology.
PSO 2	Scientific Outlook
	Scientific temperament with the help of experiments and practicals in Microbiology such as observation of microorganism through microscope, use of microbial techniques, experiments to test physiochemical factors, perform hematological procedures
PSO 3	Personal and Professional Competence
	Competence to do awareness about hematological, microorganisms and causation of diseases, environmental, agricultural issues and can work to solve the environmental issues with the help of knowledge in Microbiology.
PSO 4	Entrepreneurial Competence
	Capacity to move in the start-up of bio fertilizer, pathology lab, Food Fermentation, Production of Probiotics for good health, medical services or work for the conservation of environment or can work in such organizations.
PSO 5	Research Competence
	An ability to work over minor and preliminary research in human health, environmental issues, production of various secondary metabolites of human benefit by fermentation processes and other related issues.



(Autonomous) Department of Microbiology

Course Type: DSC-I Course Title: Introductory Microbiology Course Code: 101MIB1101 Credits: 03 Max. Ma

Max. Marks: 75

Lectures: 45 Hrs.

Learning Objectives:

- LO 1. To learn scope of microbiology.
- LO 2. To understand beneficial and harmful role of microorganism
- LO 3. To understand the contribution of scientists in development of Microbiology.
- LO 4. To study different types of microorganisms and their characteristics.
- LO 5. To study taxonomy of Microbes and methods of their classification.

Course Outcomes:

After completion of the course, students will be able to-

- CO 1. Describe Scope of microbiology in the various fields
- CO 2. Explain historical developments in microbiology
- CO 3. Explain characteristics of different types of microorganisms
- CO 4. Explain various methods of classification.
- CO 5. Explain ecofriendly applications of microbial activities for better human life

Unit No.	Title of Unit & Contents	Hrs.
Ι	Scope of Microbiology	10
	1. Definition and concept.	
	2. Distribution of Microorganisms in nature.	
	3. Scope in applied fields of Microbiology: Air Microbiology,	
	Water <mark>Microb</mark> iology, <mark>Sewa</mark> ge Microbiology, Agricultural	
	Microbio <mark>logy</mark> , Food <mark>& </mark> dairy Microbiology, Industrial	
	Microbiology, Medic <mark>al Mi</mark> crobiology.	
	4. Scope in advance <mark>d f</mark> ields of microbiology: Advanced	
	branches in Microbiology: Pharmaceutical microbiology,	
	Geomicrobiology, Nano-biotechnology and Space	
	Microbiology, Bioinformatics.	
	5. Role of Micro-organisms in human welfare-Agriculture,	
	Human health and Industries	
	Unit Outcomes: Shahu Mahavidya aya	
	UO 1. Student will be able communicate importance of	
	microorganisms in society	
	UO 2. Student will be able Execute Ecofriendly applications of	
	microbial activities for better human life.	
II	Historical developments in microbiology	12
	1. Discovery of microbial world: Contribution of Antony van	
	Leeuwenhoek	

Unit No.	Title of Unit & Contents	Hrs.
	2. Controversy over spontaneous generation - Contribution of	
	Fransisco Redi,John Needham,Lazzaro Spallanzani,Theodor	
	Schwan,Franz Schulze,Friedrich Schroder,Von Dusch,Louis	
	Pasteur,John Tyndall	
	3. Contribution of Robert Koch in Recognition of microbial	
	role in diseases and pure culture concept.	
	4. Contribution of Louis Pasteur: Recognition of microbial	
	role in Fermentation and Pasteurization .	
	5. Breakthroughs in medical field: Contribution of Joseph	
	Lister (antiseptic surgery), Paul Ehrlich (Chemotherapy),	
	Alexander Fleming (Penicillin), Discovery of Streptomycin	
	by Walksman,	
	6. Development of Immunology: Edward Jenner Vaccination,	
	(Decogratesic)	
	(Phagocytosis).	
	7. Development of Son Microbiology: Contribution of Martinus W. Boijorinck, Sorgai N. Winogradsky	
	Unit Outcome:	
	IIO 1 Student will be able to perform experiments used to	
	study role of microbes by scientists	
	IIO 2 Student will explain contribution of scientist's in	
	development of different fields of microhiology	
Ш	Types of microorganisms and their characteristics	13
	1 Types of microorganisms and their characteristics (with	20
	reference to classification, occurrence, morphology	
	replication, and importance) Bacteria (Eubacteria,	
	Archaebacteria, Actinomycetes), Protozoa, Fungi, Algae,	
	Viruses .	
	2. The eukaryotic cell structure.	
	3. The Prokaryotic cell structure.	
	4. Comparison between Eukaryotic and Prokaryotic cell.	
	5. General characteristics of Rickettsia	
	6. General characteristics Chlamydia and Mycoplasma	
	Unit Outcomes:	
	UO 1. Student will be able to describe Eukaryotic and	
	Prokaryotic cell	
	UO 2. Student will be able to examine morphological and	
	differential characteristics of different groups of	
	microorganisms	
	Daiarahi Chahu Mahauidualawa	
IV	Taxonomy of Microbes	10
	1. Classification. The Control of	
	2. Systems of classification: Three domain classification and	
	Whittaker's Five kingdom	
	3. Taxonomic Groups	
	4. Goals of classification	
	5. Nomenclature.	

Unit No.	Title of Unit & Contents	Hrs.
	 7. Bacterial Taxonomy - Introduction to Bergey's Manual of Systematics of Archae & Bacteria (BMSAB) and Bergey's International Society for Microbial Taxonomy (BISMIS). Unit Outcomes: UO 1. Student will apply this knowledge to identify microorganisms UO 2. Student will be able to describe nomenclature of 	
	microorganisms	

- 1. A Chronology of Microbiology in Historical Context, Beck R. W. (2000). United Kingdom: ASM Press.
- 2. A textbook of fungi, bacteria and Viruses, Dubey H. C. (2004),Vikas Publishing House Private Limited. New Delhi, India
- 3. A textbook of Microbiology, Dubey R. C. and D. K. Maheshwary. (2012), S Chand and Company. New Delhi, India
- 4. A Textbook of Microbiology ,Ananthanarayan and Paniker (Orient Black Swan, 7th edition) 2016
- Brock Biology of Microorganisms, Bender K. S., Buckley D. H., Stahl D. A., Sattley W. M. And Madigan M. T. (2017). E-Book, Global Edition. United Kingdom: Pearson Education.
- 6. Elementary Microbiology, Vol. I and II. Dr. A. H Modi, Akta Prakashan. Nadiad
- 7. Essentials of Microbiology, Jain A. and Jain P. (2019). Elsevier- India.
- 8. Fundamental Principles of Bacteriology, Salle A. J. (McGraw-Hill Book Co. New York and London 1973) 7th Edition
- Fundamentals of Microbiology, Frobisher M., (W. B. Saunders, Philadelphia, 1962)
 7th edition.
- 10. General Microbiology . Stanier R. Y., Ingraham J. L., Wheelis M. L. and Painter P. R., (Macmillan Education Ltd., London, 2001) 5th edition.
- 11. General microbiology ,Volume I. Powar C. B. and Daginawala H. I. (2005).. Himalaya Publishing House Private Limited, Pune, India.
- 12. General microbiology, Volume II. Powar C. B. and Daginawala H. I. (2005). Himalaya Publishing House, Private Limited, Pune, India
- 13. Microbiology: An Application based Approach, Pelczar M. J. Jr., Chan E.C.S. and Krieg N. R. (2010). McGraw-Hill Education (India) Private Limited, New Delhi, India.
- 14. Microbiology: Principles and Explorations, 7th edition. Black JG. (2008).. Prentice Hall
- 15. Principles of Microbiology, Atlas RM. (1997). 2nd edition. WM.T.Brown Publishers.



Rajarshi Shahu Mahavidyalaya, Latur (Autonomous) Department of Microbiology

Course Type: Lab Course Course Title: Lab Course –I (Based on DSC-I) Course Code: 101MIB1103

Credits: 01

Ma<mark>x. Ma</mark>rks: 50

Hours: 30

Leaning Objectives

- L O 1. To learn good laboratory practices and bio safety measures.
- L O 2. To understand principles involved in working of light microscope.
- L O 3. To study principle and working of laboratory instruments.
- L O 4. To learn staining techniques for observation of microbial morphology
- L O 5. To understand SOP for handling and disposal of microbial cultures.

Course outcomes

After completion of the course, students will be able to-

- CO 1. Appropriately prepare slides for microscopic observations.
- CO 2. Handle light microscope and observe microorganisms.
- CO 3. Use aseptic techniques for the transfer and handling of microbial cultures.
- CO 4. Prepare and use appropriate microbiological culture media and test systems;
- CO 5. Record morphology of algae, fungi and protozoa.

Practical No.	Unit
1	Bio <mark>safety in microbiolo</mark> gy laboratory
2	Biosafety measures-Laboratory sanitation
3	To understand Good laboratory practices.
4	Handling of microbial cultures precaution and disposal.
5	Microscopy- Different parts of compound microscope.
6	Use, care & Handling of compound microscope.
7	Study of laboratory equipments used for Sterilization: Autoclave,
	Hot air oven, Bacterial filters.
8	Study of laboratory equipments used for Cultivation-Incubator,
	Biosa <mark>fety cabinet Anaerobic jar.</mark>
9	Simple staining: Monochrome and Negative staining.
10	Differential: Gram's staining, acid fast staining.
11	To record morphology of algae, fungi and protozoa.

N.B.: Any Ten Practical from above.

- 1) Handbook of media, stains and reagents in microbiology, A. M. Deshmukh, PAMA publication, Karad, 1997
- 2) Microbiology, Singh R.P., Kalyani Publication.
- 3) Practical Microbiology, Dubey, Maheshwari, S. Chand, 2022
- 4) Microbiology, Yadav Manju, Discovery Publishing House, New Delhi
- 5) Biochemical Methods, s. Sadasivam and A. Manickam, New age international publishers, 2008
- 6) Handbook of Microbiology, P. S. Bisen and Kavita Verma, CBS publishers and distributors, new Delhi,2007
- Modern Tools and Techniques to Understand Microbes, Ajit Varma, Arun Kumar Sharma, Springer International Publishing, 2017.
- 8) Handbook of media, stains and reagents in microbiology, A. M. Deshmukh, PAMA publication, Karad, 1997
- 9) Microbiology, Singh R.P., Kalyani Publication.
- 10) Practical Microbiology, Dubey, Maheshwari, S. Chand, 2022
- 11) Microbiology, Yadav Manju, Disc<mark>overy Publishing H</mark>ouse, New Delhi
- 12) Biochemical Methods, s. Sadasivam and A. Manickam, New age international publishers, 2008
- 13) Handbook of Microbiology, P. S. Bisen and Kavita Verma, CBS publishers and distributors, new Delhi,2007
- 14) Modern Tools and Techniques to Understand Microbes, Ajit Varma, Arun Kumar Sharma, Springer International Publishing, 2017





(Autonomous)

Department of Microbiology

Course Type: DSC-II

Course Title: Methods in Microbiology

Course Code: 101MIB1102

Credits: 03

Max. Marks: 75

Lectures: 45 Hrs.

Learning Objectives

- LO 1. To understand principle and working of light microscope
- LO 2. To understand principle and working of light microscope
- LO 3. To learn microbial staining technique.
- LO 4. To study different agents and methods of sterilization.
- LO 5. To study agents used for controlling growth of microorganisms.

Course outcomes

After completion of the course, students will be able to-

- CO 1. Apply staining methods to observe different morphological forms of microorganisms.
- CO 2. Handle microscope for observation of microorganisms.
- CO 3. Apply different methods of sterilization.
- CO 4. Perform pure culture techniques.
- CO 5. Explain effect of various environmental factors on growth.

Unit No.	Title of Unit & Contents	Hrs
Ι	Microscopy	10
	1. Terms in microscopy – Electromagnetic spectrum of light,	
	concepts of magnif <mark>icatio</mark> n, Refractive index, Numerical	
	aperture, Resolving p <mark>ower</mark>	
	2. Types of Microscope <mark>s : B</mark> right field, Dark field, Phase contrast,	
	fluorescent microscope	
	3. Compound Microscope: Part of microscope -condensers,	
	eyepieces and objectives, image formation, Ray diagram and	
	applications.	
	4. Concept of aberrations in lenses - spherical, chromatic.	
	5. Electron Microscope –Parts, principle of image formation, Ray	
	diagram and applications.	
	Comparative study of compound and electron microscope.	
	Unit Outcome:	
	UO 1.Student will explain design and working of microscope.	
	110.2 Student can observe microorganisms using microscope	
	00 2. Student can observe interoorganishis using interoscope	
II	Microbial Staining Techniques	12
	1. Definitions: Stain, Dye, Mordent, Chromogen , Leuco	

	compound, Flurochrome ,Decolorizing agent and Counter	
	stain.	
	2. Types of stains: Auxochrome, chromophore, Acidic stain,	
	Basic stain, Neutral stain ,Chromogen.	
	3. Theories of Staining: Physical and chemical.	
	4. Simple staining: Monochrome & Negative staining (Principles,	
	Mechanism, Procedure and Observation).	
	5. Differential staining: Gram's and Acid Fast staining	
	(Principles, Mechanism, Procedure and Observation).	
	6. Structural staining: Cell wall, Capsule, Endospore, Flagella.	
_	PHB and Metachromatic granule Staining.	
	Unit Outcome:	
	UO 1. Student will be able to identify various morphological	
	forms of bacteria using s <mark>imple a</mark> nd differential staining	
	techniques.	
	UO 2. Student will be abl <mark>e to use staining methods for</mark>	
	observation of different s <mark>tructures of</mark> bacteria.	
III	Sterilization and disinfection	13
	1. Definition of Sterilization, Disinfection, Antiseptic, Germicide,	
	Sanitizer, Fungicide, Vermicide, Bacteriostatic and	
	Bactericidal agent.	
	2. Sterilization by Physical Agent Heat: Moist Heat: Steam	
	under pressure (Autoclaving), Boiling, Pasteurization	
	Dry heat: Incineration, Hot air Oven.	
	Radiation: Ionizing and Non-ionizing radiations.	
	Filtration: Types of Bacteriological filters	
	3. Chemical Disinfectants -Characteristics of an ideal	
	disinfectant, Evaluation of Disinfectant by Phenol Coefficient	
	method.	
	4. Chemical Agents: Phenol and Phenolic compounds, Alcohols,	
	Halogens.	
	5. Gaseous sterilizing Agents: Formaldehyde, Ethylene Oxide, β -	
-	Propiolactone.	
	Unit Outcomes:	
	00 1. Student will be able to apply methods of sterilization and	
	disinfection	
	UO 2. Student can app <mark>ly t</mark> his knowledge for personal hygiene	
IV	Effect of environmental factors on microbial growth and	10
	survival	
	1. Effect of Temperature on Growth	
	2. Effect of pH (Acidic environment) on Growth.	
	3. Effect of Osmotic pressure (Saline environment) on	
	Growth.	
	4. Effect of Oxygen on Growth.	
	5. Effect of Hydrostatic pressure on Growth.	
	6. Effect of Heavy metals on Growth.	
	Survival of bacteria under unfavorable conditions:	
	Endognone and grat	
	Endospore and cyst.	
-	Unit Outcome:	

factors on microbial growth.	
UO 2. Student will be able to apply this concept for controlling microbial growth	

- 1. A textbook of Microbiology. Dubey R. C. and D. K. Maheshwary. (2012). S Chand and Company. New Delhi, India
- Brock Biology of Microorganisms. Bender K. S., Buckley D. H., Stahl D. A., Sattley W. M. And Madigan M. T. (2017). E-Book, Global Edition. United Kingdom: Pearson Education.
- 3. Elementary Microbiology Vol. I and II. Dr. A. H Modi. Akta Prakashan. Nadiad
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- 5. Fundamental Principles of Bac<mark>teriology</mark>, Salle A. J. (McGraw-Hill Book Co. New York and London 1973) 7th Edition
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- 8. General microbiology Volume I. Powar C. B. and Daginawala H. I. (2005).. Himalaya Publishing House Private Limited, Pune, India.
- 9. General microbiology Volume II. Powar C. B. and Daginawala H. I. (2005). Himalaya Publishing House, Private Limited, Pune, India
- 10. Microbiology by Prescott L.M. Harley J.P. and Klein Donald A., W. M. C. Brown publishers.
- 11. Microbiology: An Application based Approach. Pelczar M. J. Jr., Chan E.C.S. and Krieg N. R. (2010). McGraw-Hill Education (India) Private Limited, New Delhi, India.
- 12. Microbiology: Fundamentals and Applications by Purohit S.S. Agro-Botanical publishers Bikaner, India.
- 13. Microbiology: Principles and Explorations. 7th edition. Black JG. (2008).. Prentice Hall
- 14. Principles of Microbiology. Atlas RM. (1997). 2nd edition. WM.T.Brown Publishers.



(Autonomous)

Department of Microbiology

Course Type: Lab Course

Course Title: Lab Course -II (Based on DSC-II)

Course Code: 101MIB1104

Credits: 01	Max <mark>. Ma</mark> rks: 50	Hours: 30

Learning Objectives

LO 1. To study technique for measurement bacterial size

- LO 2. To stain and observe structural features of bacterial cells.
- LO 3. To study methods of controlling microbial growth and contaminants.
- LO 4. To study preparation and sterilization of simple media.
- LO 5. To study preparation and sterilization of differential media.

Course outcomes

After completion of course the student will be able to-

- CO 1. Determine size of microorganisms.
- CO 2. Perform staining of cell structures and record observations.
- CO 3. Use aseptic techniques .
- CO 4. Prepare and sterilize culture media.

CO 5. Prepare agar plates and agar slants.

Practical No.	Unit
1	Measurement of bacterial cell size: Micrometry.
2	Staining and observation of Cell wall and Capsule.
3	Staining of Endospo <mark>res by Dorner's</mark> method
4	Staining of Flagella by PKG method
5	Staining and observation of PHB granules .
6	Demonstration of <mark>basic</mark> techniques in Microbiology: Wrapping of
	glassware, cotton <mark>plug</mark> ging, cleaning and washing glassware.
7	Preparation and sterilization of Nutrient broth , Nutrient Agar,
	MacConkey's Broth , MacConkey's Agar and Sugar fermentation media.
8	Preparation of Simple medium for cultivation of autotrophs.
9	To Study methods for Controlling growth and spread of microbes in
	laboratory Shahu Wahayi dyalaya
10	To understand SOP for biological waste disposal
	Latur (Autonomous)

Learning Resources:

1) Handbook of media, stains and reagents in microbiology, A. M. Deshmukh, PAMA publication, Karad, 1997

- 2) Microbiology, Singh R.P., Kalyani Publication.
- 3) Practical Microbiology, Dubey, Maheshwari, S. Chand, 2022
- 4) Microbiology, Yadav Manju, Discovery Publishing House, New Delhi
- 5) Biochemical Methods, s. Sadasivam and A. Manickam, New age international publishers, 2008
- 6) Handbook of Microbiology, P. S. Bisen and Kavita Verma, CBS publishers and distributors, new Delhi,2007
- 7) Modern Tools and Techniques to Understand Microbes, Ajit Varma, Arun Kumar Sharma, Springer International Publishing, 2017.
- 8) Handbook of media, stains and reagents in microbiology, A. M. Deshmukh, PAMA publication, Karad, 1997
- 9) Microbiology, Singh R.P., Kaly<mark>ani Pub</mark>lication.
- 10) Practical Microbiology, Dubey<mark>, Mahes</mark>hwari, S. Chand, 2022
- 11) Microbiology, Yadav Manju, D<mark>iscovery Pu</mark>blishing House, New Delhi
- 12) Biochemical Methods, s. Sadasiyam and A. Manickam, New age international publishers, 2008
- 13) Handbook of Microbiology, P. S. Bisen and Kavita Verma, CBS publishers and distributors, new Delhi,2007
- 14) Modern Tools and Techniques to Understand Microbes, Ajit Varma, Arun Kumar Sharma, Springer International Publishing, 2017





(Autonomous)

Department of Microbiology

Course Type: VSC-I

Course Title: Food Fermentation Technology

Course Code: 101MIB1501

Credits: 02

Max. Marks: 50

Lectures: 30 Hrs.

Learning Objectives:

- LO 1. To emphasize vocational imp<mark>ortance of f</mark>ermented food technology
- LO 2. To explain the advantages and health benefits of fermented foods
- LO 3. To demonstrate the role of microorganisms in production of fermented foods
- LO 4. To develop skills and techniques for production of fermented food products

Course Outcomes:

After completion of the course, students will be able to-

- CO 1. Describe the health benefits of fermented food products
- CO 2. Describe the biochemical and technological aspects of fermented foods
- CO 3. Design their own marketable products using the basic knowledge of fermentation technology

Unit No.	Title of Unit & Contents	Hrs.
Ι	Introduction to Fermentation Process:	8
	Fermenta <mark>tion proce</mark> ss and <mark>microorgan</mark> isms involved in it, Fermentation	
	media and <mark>condition</mark> s of fe <mark>rmenta</mark> tio <mark>n, Desig</mark> n of fermenter. Fermente	
	and Probioti <mark>cs - De</mark> finition <mark>, type</mark> s, advantages and health benefits	
	Unit Outcomes:	
	UO 1. Students able to explain the fermented foods and their	
	advantages in human health	
	UO 2 <mark>. Students able to observe and recognize different types o</mark> f	
	microorganisms involved in food fermentation process	
II	Milk Based Fermented Foods	7
	Curd, Yogurt, and cheese: Preparation of inoculums, types of	
	microorganisms, Biochemical process	
	Unit Outcomes: dtuf (Autonomous)	
	UO 1. Students able to explain different types of fermented milk	
	products and the biochemical reactions involved in its production	
	UO 2. Students will prepare inoculum and produce yogurt	
III	Vegetable and Fruit based Fermented Foods	8

		T
	Pickles, Sauerkraut, wine: Microorganisms involved, Biochemical	
	activity and Production process	
	Unit Outcome:	
	UO 1. Students able to explain different types of fermented	
	Vegetable and fruit products and the biochemical acitivities	
	involved in its production	
	UO 2. Students will prepare picle and fruit wine.	
IV`	Cereal Based Fermented Foods	7
	Idli, Dosa, Fermented millet: Mi <mark>cro</mark> organisms, Biochemical activity	
	and Production process	
	Unit Outcomes:	
	UO 1. Students able to expl <mark>ain diff</mark> erent types of fermented cereal	
	products and the biochemi <mark>cal activ</mark> ities involved in its production	
	UO 2. Students will prepare idli	
V	Practicals (Included in above 04 units)	
	1. Demonstration of different types of microorganisms involved	
	in fermentation proces <mark>s</mark>	
	2. Preparation of inoculum for milk based fermented foods	
	3. Production of Yogurt	
	4. Production of pickle	
	5. Production of fruit Wine	
	6. Production <mark>of Idli</mark>	

- 1. An Introduction to Industrial Microbiology. K. Sukesh. S. Chand Limited · 2010
- **2.** Handbook of food and fermentation technology. Hui YH, Meunier-Goddik L, Josephsen J, Nip WK, Stanfield PS. CRC Press. 2004.
- **3.** Advances in Fermented Foods and Beverages. Holzapfel W. Woodhead Publishing. 2014.
- 4. A comprehensive dairy microbiology. Yadav JS, Grover, S and Batish VK. Metropolitan. 1993.
- 5. Industrial Microbiology. David B. Wilson, Hermann Sahm, Klaus-Peter Stahmann, Mattheos Koffas. Wiley. 2019
- 6. Ethnic Fermented Foods and Beverages of India: Science History and Culture. Jyoti Prakash Tamang. Springer Nature Singapore. 2020
- 7. Microbial Production of Fermented Foods. Nandkishor Jha. Link: <u>https://www.biologydiscussion.com/foods/microbial-production-of-fermented-foods/10402</u>
- 8. Model Project Report on Fruit & Vegetable Processing Unit. National Bank for Agriculture and Rural Development. July, 2024



(Autonomous)

Department of Microbiology

Course Type: DSC-III Course Title: Basics of Microbiology and Biomolecules Course Code: 101MIB2101 Credits: 03 Max. Marks: 75

Lectures: 45 Hrs.

Learning Objectives:

- LO 1. Understand structure of cell, cell organelles and their functions
- LO 2. Understand viral structure, replication and cultivation.
- LO 3. Understand glycoside linkage and structures of carbohydrates and lipids.
- LO 4. Understand structure and classification of proteins and nucleic acid, highlighting their biological significance.

Course Outcomes:

After completion of the course, students will be able to-

- CO 1. Analyze the structure, chemical composition, and functions of bacterial cellular components, including dormant forms.
- CO 2. Describe the historical development and general characteristics of viruses, including their distribution among bacterial, plant, and animal hosts
- CO 3. Explain the structures and classifications of carbohydrates and lipids, emphasizing their biological significance.
- CO 4. Describe the structures and functions of DNA and RNA, and their importance in genetic information.

Unit No.	Title of Unit & Contents	Hrs.
Ι	Ultra structure of bacterial cell	12
	 Structure, Chemical composition and function of following:- 1. Capsule and slimes 2. Cell wall and Cytoplasmic membranes 3. Flagella and Motility, fimbriae and pili 4. Nuclear material, Plasmids, Mesosomes, Ribosome 5. Reserve materials and other cellular inclusions. 6. Dormant forms of prokaryote: Endospore and cyst 	
	 Unit Outcomes: Students will be able to UO 1. Differentiate between the capsule and slime layers, describing their respective structures and compositions UO 2. Demonstrate comprehension of the structural characteristics of the cell wall and cytoplasmic membranes, linking them to their functions 	

Unit No.	Title of Unit & Contents	Hrs.
II	The Viruses: Distribution and structure	12
	 Viruses: History General characteristics of viruses Bacterial, plant and animal viruses Multiplication of Virulent phage: The lytic cycle The development of temperate phages: Lysogeny Cultivation of viruses Viruses like agent :Viroids, Prion, Satellites Unit Outcome: Students will be able to UO 1. Understand the role of flagella in bacterial motility, as well as the functions of fimbriae and pili in attachment and biofilm formation 	
III	Biomolecules	11
	 1. Carbohydrates: Definition and classification a) Monosaccharides Glucose, Galactose, Ribose, Xylose b) Disaccharides:- Glycoside linkage (Lactose, Maltose and Sucrose) c) Oligosaccharides:- Trisaccharides (Structure of Raffinose) d) Polysaccharides:- Homo and Heteropolysaccharides Structure (Starch, Cellulose,) 2. Lipids: Definition and classification, Biological significance Unit Outcomes: Students will be able to UO 1. Describe methods of microbial reproduction, their growth phases and measurement of growth UO 2. Explain the types of bacterial cultures and their significance 	
IV	Functional and Informational Biomolecules	10
	 Proteins: Definition and Classification a) Peptide bond: Configurations of proteins b) Biological significance of proteins Nucleic Acids: a) Nucleosides and Nucleotides. b) Structure and functions of DNA c) Structure, types and functions of RNA Unit Outcomes: Students will be able to UO 1. Explain types and importance of biomolecules in 	

- 1. Microbiology. Pelczar, Chan and Krieg. McGraw-Hill Inc.US
- 2. General Microbiology. Powar and Daginawala. Vol-I. Himalaya Publishing House
- 3. Elementary Microbiology (Fundamentals of Microbiology). Modi H.A.: Vol. II. Ekta Prakashan, Nadiad, Gujrat.
- 4. Biochemistry, Seventh Edition. Jeremy M. Berg, John L. Tymoczko and Lubert Stryer, W.H. Freeman & Company. 2010
- 5. Lehninger: Principles of Biochemistry. Albert L. Lehninger, Michael Cox and DavidL. Nelson (4 May 2004), W. H. Freeman.
- 6. Microbiology: Fundamentals and Applications. Purohit S.S. Agro-Botanical publishers. Bikaner, India.
- 7. Biochemistry, 4th edn. Dubuqu<mark>e, IO: W</mark>illiam C Brown
- 8. Handbook of Biochemistry and Molecular Biology
- 9. Biochemistry, 3rd Edition, by Drs. John W. Pelley, and Edward F. Goljan.
- 10. The Cell: A Molecular Approach by Geoffrey M. Cooper, and Robert E. Hausman





(Autonomous) Department of Microbiology

Course Type: Lab Course Course Title: Lab Course III (Based on DSC III) Course Code: 101MIB2103 Credits: 01 Max. Marks: 50

Hours: 30

Learning Objectives:

- LO 1 To study method for isolation of coliphages.
- LO 2 To study qualitative and quantitative analysis of carbohydrates and proteins
- LO 3 To study principles and procedure of qualitative analysis of nucleic acids

Course Outcomes:

- After completion of the course, students will be able to -
- CO 1 Demonstrate method for the presence of viruses.
- CO 2 Perform qualitative and quantitative assay of carbohydrates and proteins
- CO 3 Perform qualitative and quantitative assay of nucleic acids

Practical No.	Unit
1	Isolation of coliphages from sewage water.
2	Qualitative and quantitative analysis of Carbohydrates by Sumner's method
3	Qualitative and quantitative analysis of Protein by Biuret test
4	Qualitative and quantitative analysis of DNA by Diphenyl amine test
5	Qualit <mark>ative an</mark> d quan <mark>titativ</mark> e analysis of RNA by Orcinol test
6	Effect of physical agents on growth of bacteria: pH, Temperature U.V. rays(Demonstration)
7	Effect of chemical agents on bacterial growth: Antibiotic and Phenolic compounds.
8	Effect of Heavy metal ions (Oligodynamic Action)

Learning Resources: Learning Resources:

- 1) Handbook of media, stains and reagents in microbiology, A. M. Deshmukh, PAMA publication, Karad, 1997
- 2) Microbiology, Singh R.P., Kalyani Publication.
- 3) Practical Microbiology, Dubey, Maheshwari, S. Chand, 2022
- 4) Microbiology, Yadav Manju, Discovery Publishing House, New Delhi

- 5) Biochemical Methods, s. Sadasivam and A. Manickam, New age international publishers, 2008
- 6) Handbook of Microbiology, P. S. Bisen and Kavita Verma, CBS publishers and distributors, new Delhi,2007
- 7) Modern Tools and Techniques to Understand Microbes, Ajit Varma, Arun Kumar Sharma, Springer International Publishing, 2017
- 15) Handbook of media, stains and reagents in microbiology, A. M. Deshmukh, PAMA publication, Karad, 1997
- 16) Microbiology, Singh R.P., Kalyani Publication.
- 17) Practical Microbiology, Dubey, Maheshwari, S. Chand, 2022
- 18) Microbiology, Yadav Manju, Discovery Publishing House, New Delhi
- 19) Biochemical Methods, s. Sadasivam and A. Manickam, New age international publishers, 2008
- 20) Handbook of Microbiology, P. S. Bisen and Kavita Verma, CBS publishers and distributors, new Delhi,2007
- 21) Modern Tools and Techniques to Understand Microbes, Ajit Varma, Arun Kumar Sharma, Springer International Publishing, 2017





(Autonomous)

Department of Microbiology

Course Type: DSC-IV Course Title: Microbial Nutrition and Growth Course Code: 101MIB2102 Credits: 03 Max. Marks: 75

Lectures: 45 Hrs.

Learning Objectives:

- LO1 To understand the properties, preparation of different types of culture media and Bacterial cultivation techniques
- LO2 To understand the nutritional requirements of bacteria and transport mechanisms
- LO3 To understand the bacterial growth pattern and measurement of growth
- LO4 To acquire knowledge of important biomolecule and their significance in microbial life

Course Outcomes:

After completion of the course, students will be able to-

- CO1 Describe the significance of cultivation media and pure culture techniques
- CO2 Explain the necessary nutritional elements and their transport mechanisms
- CO3 Explain the phases of microbial growth and methods of growth measurement
- CO4 Describe the importance microbial cell growth

Unit No.	Title of Unit & Contents	Hrs.
Ι	Cultivation media and Pure culture methods	12
	 Definitions - pure culture, mixed culture, consortium, axenic 	
	cultu <mark>re, contamin</mark> ation.	
	 Properties of a good culture medium. 	
	3. General ingredients of culture media and their role	
	4. Definition, Concept, Use and Types of different culture media – Living and Nonliving media – Synthetic Non-	
	synthetic Natural Selective Differential Enriched	
	Enrichment Assay Minimal Maintenance and Transport	
	Medium.	
	5. Buffers in culture medium	
	6. Isolation and Cultivation of bacteria: Principle and method	
	o <mark>f isolation-streak plate, pour plate, spread plate, single ce</mark> ll	
	isolation, Anaerobic bacteria	
	Unit Outcomes: Students will be able to	
	110.1 Describe the role of general ingredients of culture media	
	IIO 2 Describe the various types of culture media and	
	techniques of isolation and cultivation of bacteria	
II	Microbial Nutrition and nutrient transport	12
	1. Major bio-elements, Minor bio-elements, Growth factors	

Unit No.	Title of Unit & Contents	Hrs.
	 Nutritional categories of microorganisms on the basis of carbon and energy source Nutrient transport and membrane function: Modes of nutrition, primary and secondary transport, porins, OMP, carrier proteins Passive and Facilitated diffusion Group translocation and Active transport mechanisms Unit Outcome: UO 1. Describe the nutritional essentials for microbial growth 	
III	Microbial Growth	11
	 Microbial Growth - Binary fission, Budding, fragmentation and formation of Conidiospores Mathematical expression of growth Growth curve and diauxic growth Measurement of growth: cell number, cell mass, cell activity Different types of bacterial cultures -Batch culture, continuous culture, synchronous culture Unit Outcomes: Students will be able to U0 1. Describe methods of microbial reproduction, their growth phases and measurement of growth Explain the types of bacterial cultures and their significance 	
IV	Microbial Growth	10
	 Microbial Growth – Binary fission, Budding, fragmentation and formation of conidiophores Mathematical expression of growth Growth curve and diauxic growth Measurement of growth: cell number, cell mass and cell activity Different types of bacterial cultures –Batch culture, continuous culture, synchronous culture Explain the bacterial growth pattern and measurement of growth 	

- 1. Microbiology. Pelczar, Chan and Krieg. McGraw-Hill Inc.US
- 2. General Microbiology. Powar and Daginawala. Vol-I. Himalaya Publishing House
- 3. Elementary Microbiology (Fundamentals of Microbiology). Modi H.A.: Vol. II. Ekta Prakashan, Nadiad, Gujrat.
- 4. Biochemistry, Seventh Edition. Jeremy M. Berg, John L. Tymoczko and Lubert Stryer, W.H. Freeman & Company. 2010

- 5. Lehninger: Principles of Biochemistry. Albert L. Lehninger, Michael Cox and DavidL. Nelson (4 May 2004), W. H. Freeman.
- 6. Microbiology: Fundamentals and Applications. Purohit S.S. Agro-Botanical publishers. Bikaner, India.



Rajarshi Shahu Mahavidyalaya, Latur (Autonomous) Department of Microbiology

िका फर्मा स्वित्य संस्था उत्तर स्वापना - १९७०

Course Type: Lab Course Course Title: Lab Course IV (Based on DSC IV) Course Code: 101MIB2104 Credits: 01 Max. Marks: 50

Hours: 30

Learning Objectives:

- LO 1 To study microbial techniques for isolation of microorganisms in pure culture.
- LO 2 To gain knowledge related to cultivation of anaerobic spore formers
- LO 3 To understand SOP for disposal of microbial culture.
- LO 4 To understand methods of stock culture maintance.

Course Outcomes:

After completion of course the student will be able to-

- CO 1 Perform isolation of bacterial cultures.
- CO 2 Carry out cultivation of anaerobic spore formers, fungi and algae .
- CO3. Execute SOP for disposal of microbial culture.

CO 4. Maintain stock cultures of microorganisms.

Practical No.	Unit
1	To stud <mark>y Streak plate method methods for Isolation o</mark> f bacteria
2	To study spread plate method for Isolation of bacteria
3	To study Pour plate method for enumeration of microorganisms from
	soil sample.
4	Cultivation of anaerobic spore forming bacteria from cow dung or
	agriculture waste
5	To pe <mark>rform</mark> isolatio <mark>n of f</mark> ungi from rotten vegetables
6	To perf <mark>orm</mark> cultiva <mark>tion o</mark> f blue green algae
7	Study of bacterial growth curve (Demonstration)
8	To study stock culture maintenance methods : Serial sub culturing, soil
	stocks and refrigeration.



(Autonomous) Department of Microbiology

Course Type: VSC-II Course Title: Bio pesticide production Course Code: Credits: 02 Max. Marks: 50

Lectures: 30 Hrs.

Learning Objectives:

- LO 1. To study impact of pesticide on environment and Human health.
- LO 2. To study application of microbes as bio controlling agents
- LO 3. Understand technology of biopesticides production
- LO 4. Determine impact of bio pesticide in field

Course Outcomes:

After completion of the course, students will be able to-

- CO 1. Identify specific adverse effects on non-target species, leading to informed measures for sustainable pesticide use.
- CO 2. Identify of specific microorganisms effective as biocontrolling agents, contributing to the development of environmentally friendly and sustainable pest management strategies
- CO 3. Acquired a comprehensive understanding of biopesticide production technology empowers students to actively contribute to sustainable agriculture practices, promoting environmentally friendly alternatives for pest management.
- CO4. Gain practical insights for effective and sustainable pest management practices.

Unit No.	Title of Unit & Contents	Hrs.
Ι	Introduction : Pesticides and Bio pesticides	8
	1. Classification of pesticides Types of Pest and pesticides	
	2. Mechanism of toxicity, use in agriculture and house hold	
	practices	
	3. Biodegradable and non-biodegradable pesticides	
	4. Impact of pesticides on environment and human health,	
	opportunities and challenges	
	Unit Outcomes: O Shanu Manavioyalaya	
	UO 1. Students able to explain impact of pesticide	
	UO 2. Students able to observe and recognize different types of	
	microorganisms involved in Biopesticide production.	
II	Microbes as bio controlling agent.	7
	1. Pests and Bio pesticides	
	2. Bio control potential of : <i>Bacillus</i> sp. <i>Pseudomonas,</i>	

	Trichoderma	
	Unit Outcomes:	
	UO 1. Students able to explain different types of Microorganisms	
	involved in Bio pesticides production	
III	Production of bio pesticides	8
	1. Screening of Bio control agent	
	2. Isolation , cultivation and mass production	
	3. Formulation and testing in-vitro	
	Unit Outcome:	
	UO 1. Students able to explain Screening procedure for	
	biopesticides	
	UO 2. Students will prepar <mark>e biope</mark> sticides.	
IV`	Field Study	7
	1. Application of Form <mark>ulation in th</mark> e field	
	2. Preparation of Repo <mark>rt</mark>	
	Unit Outcomes:	
	UO 1. Students able to explai <mark>n different applica</mark> tion of biopesticides	
	UO 1. Students able to explain different application of biopesticides production .	
	UO 1. Students able to explain different application of biopesticides production .	
V	UO 1. Students able to explain different application of biopesticides production . Practicals (Included in above 04 units)	
V	UO 1. Students able to explain different application of biopesticides production . Practicals (Included in above 04 units) 1. To isolate plant pathogens from infected plants	
V	UO 1. Students able to explain different application of biopesticides production . Practicals (Included in above 04 units) 1. To isolate plant pathogens from infected plants 2. To isolate Bacillus sp from soil	
V	UO 1. Students able to explain different application of biopesticides production . Practicals (Included in above 04 units) 1. To isolate plant pathogens from infected plants 2. To isolate Bacillus sp from soil 3. To isolate Pseudomonas sps from soil	
V	UO 1. Students able to explain different application of biopesticides production . Practicals (Included in above 04 units) 1. To isolate plant pathogens from infected plants 2. To isolate Bacillus sp from soil 3. To isolate Pseudomonas sps from soil 4. To isolate Actinomycetes strains from soil	
V	UO 1. Students able to explain different application of biopesticides production . Practicals (Included in above 04 units) 1. To isolate plant pathogens from infected plants 2. To isolate Bacillus sp from soil 3. To isolate Pseudomonas sps from soil 4. To isolate Actinomycetes strains from soil 5. To determine biocontrol potential of isolates	
V	UO 1. Students able to explain different application of biopesticides production . Practicals (Included in above 04 units) 1. To isolate plant pathogens from infected plants 2. To isolate Bacillus sp from soil 3. To isolate Pseudomonas sps from soil 4. To isolate Actinomycetes strains from soil 5. To determine biocontrol potential of isolates 6. formulation of biopesticides	

- 1. Opender Koul, Gadi V. P. Reddy, George W. Cuperus, Biopesticides: State of the Art and Future Opportunities" CRC Press, 2019
- 2. Philip W. C. Green "Bio pesticides Handbook", Wiley-Blackwell 2015.
- 3. Fereti A. Kyerematen "Bio pesticides: Use and Delivery", Humana Press, 2020
- 4. Rajeev K. Upadhyay, Narendra K. Dubey, Ashok K. Upadhyaya "Biopesticides: Production and Application" CABI, 2018
- 5. Rachana Singh, Rudra Deo Tripathi, Vivek K. Singh"Biopesticides in Sustainable Agriculture", Springer2014.



(Autonomous)

UG First Year

Basket I: Generic/Open Elective (GE/OE)

(GEs offered to the Science & Technology students in Sem.-I)

Sr.	BoS Proposing	Code Course Title		Credits	Hrs.
No.	GE/OE				
1	Commerce	101ENG <mark>1401</mark>	Mutual Fund Management	04	60
2	Commerce	101C0 <mark>S1401</mark>	Fundamentals of Statistics	04	60
3	English	101C0 <mark>A1401</mark>	English for Science and Technology	04	60
4	Geography	101MA <mark>R1401</mark>	General Geography	04	60
5	Commerce	101MA <mark>T1401</mark>	Personal Financial	04	60
			Management		
6	Marathi	101POL <mark>1401</mark>	स्पर्धा परीक्षा आणि मराठी	04	60
			भाषा		
7	Political Science	101BI01401	Human Rights	04	60
8	Biotechnology	101COM1401	Nutrition, Health and	04	60
			Hygiene		
9	Music	101MUS1401	Indian Vocal Classical &	04	60
			Light Music		
10	NCC Studies	101NCC1401	Introduction to NCC	04	60
11	Sports	101SP01401	Counseling and	04	60
			Psychotherapy		

Note: Student can choose any one GE from the basket.

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ण संस्था



(Autonomous)

UG First Year

Basket II: Skill Enhancement Courses (SEC)

(SEC offered to the Science & Technology students in Sem.-I)

Sr. No.	BoS Proposing SEC	Code	Course Title	Credits	Hrs.
1	Chemistry	101MAE16 <mark>01</mark>	Pesticides and Green Chemistry	02	30-45
2	Information Technology	101COS16 <mark>01</mark>	Basics of Python Programming	02	30-45
3	Physics	101ENG160 <mark>1</mark>	Physics Workshop Skills	02	30-45
4	Biotechnology	101ENG160 <mark>2</mark>	Food Processing Technology	02	30-45
5	Botany	10 <mark>1GE</mark> 01601	Mushroom Cultivation Technology	02	30-45
6	English	1 <mark>01COA1601</mark>	Proof Reading and Editing	02	30
7	Information Technology	101MAR1601	PC Assemble and Installation	02	30-45
8	Marathi	101ENG1603	कथा/पटकथालेखन	02	30
9	Zoology	101Z001601	Bee Keeping	02	30-45

Note: Student can choose any one SEC from the basket.

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(Autonomous)

UG First Year

Basket III: Ability Enhancement Courses (AEC)

(AEC offered to the Science & Technology students in Sem.-I)

Sr. No.	BoS Proposing AEC	Code	Course Title	Credits	Hrs.
1	Marathi	101MAR7101	भाषिक कौशल्य भाग – १	02	30
2	Hindi	101HIN7 <mark>101</mark>	हिंदी भाषा शिक्षण भाग – १	02	30
3	Sanskrit	101SAN7 <mark>101</mark>	व्यावहारीक व्याकरण व नितिसुभाषिते	02	30
4	Pali	101PAL71 <mark>01</mark>	उपयोजित व्याकरण	02	30

शेव छत्रपती

ण संस्था

Note: Student can choose an<mark>y o</mark>ne A<mark>EC from the basket.</mark>





(Autonomous)

UG First Year

Extra Credit Activities

Sr.	Course Title	Credits	Hours	
No.			T/P	
1	MOOCs	Min. of 02 credits	Min. of 30 Hrs.	
2	Certificate Courses	Min. of 02 credits	Min. of 30 Hrs.	
3	IIT Spoken English	Min. of 02 credits	Min. of 30 Hrs.	
	Courses			

Guidelines:

Extra -academic activities

- 1. All extra credits claimed under this heading will require sufficient academic input/ contribution from the students concerned.
- 2. Maximum 04 extra credits in each academic year will be allotted.
- 3. These extra academic activity credits will not be considered for calculation of SGPA/CGPA but will be indicated on the grade card.

Additional Credits for Online Courses:

- 1. Courses only from SWAYAM and NPTEL platform are eligible for claiming credits.
- 2. Students should get the consent from the concerned subject Teacher/Mentor/Vice Principal and Principal prior to starting of the course.
- 3. Students who complete such online courses for additional credits will be examined/verified by the concerned mentor/internal faculty member before awarding credits.
- 4. Credit allotted to the course by SWAYAM and NPTEL platform will be considered as it is.

Additional Credits for Other Academic Activities:

- 1. One credit for presentation and publication of paper in International/National/State level seminars/workshops.
- 2. One credit for measurable research work undertaken and field trips amounting to 30 hours of recorded work.
- 3. One credit for creating models in sponsored exhibitions/other exhibits, which are approved by the concerned department.
- 4. One credit for any voluntary social service/Nation building exercise which is in collaboration with the outreach center, equivalent to 30 hours
- 5. All these credits must be approved by the College Committee.

Additional Credits for Certificate Courses:

- 1. Students can get additional credits (number of credits will depend on the course duration) from certificate courses offered by the college.
- 2. The student must successfully complete the course. These credits must be approved by the Course Coordinators.
- 3. Students who undertake summer projects/ internships/ training in institutions of repute through a national selection process, will get 2 credits for each such activity. This must be done under the supervision of the concerned faculty/mentor.

Note:

- 1. The respective documents should be submitted within 10 days after completion of Semester End Examination.
- 2. No credits can be granted for organizing or for serving as office bearers/ volunteers for Inter-Class / Associations / Sports / Social Service activities.
- 3. The office bearers and volunteers may be given a letter of appreciation by the respective staff coordinators. Besides, no credits can be claimed for any services/activities conducted or attended within the college.
- 4. All claims for the credits by the students should be made and approved by the mentor in the same academic year of completing the activity.
- 5. Any grievances of denial/rejection of credits should be addressed to Additional Credits Coordinator in the same academic year.
- 6. Students having a shortage of additional credits at the end of the third year can meet the Additional Credits Coordinator, who will provide the right advice on the activities that can help them earn credits required for graduation.





(Autonomous)

Examination Framework

Theory:

40% Continuous Assessment Tests (CATs) and 60% Semester End Examination (SEE)

Practical:

50% Continuous Assessment Tests (CATs) and 50% Semester End Examination (SEE)

Course	Marks	CAT & Mid Term Theory				CAT Practical		Best Scored CAT & Mid Term	SEE	Total
		3			4					
1	2	Att.	CAT I	Mid	CAT	Att.	CAT	5	6	5+6
				Term	II					
DSC/DSE/	100	10	10	20	10	-	-	40	60	100
GE/OE/Minor										
DSC	75	05	10	15	10	-	-	30	45	75
Lab	50	-		-	-	05	20	-	25	50
Course/AIPC/			1.1.1							
OJT/FP										
VSC/SEC/	50	05	05	10	05	-	-	20	30	50
AEC/VEC/CC										

Note:

- 1. All Internal Exams are compulsory
- 2. Out of 02 CATs best score will be considered C
- 3. Mid Term Exam will be conducted by the Exam Section
- 4. Mid Term Exam is of Objective nature (MCQ)
- 5. Semester End Exam is of descriptive in nature (Long & Short Answer)
- 6. CAT Practical (20 Marks): Lab Journal (Record Book) 10 Marks, Overall Performance 10 Marks.