# DR. BABASAHEB AMBEDKAR MARATHWADA UNIVERSITY, CHHATRAPATI SAMBHAJINAGAR.



# CIRCULAR NO.SU/Revised B.Sc./NEP/72/2024

It is hereby inform to all concerned that, the Revised syllabi prepared by the Board of Studies/Ad-hoc Boards and recommended by the Dean, Faculty of Science & Technology, Academic Council at its meeting held on 08 April 2024 has accepted the following Revised syllabi of Bachelor of Science under the Faculty of Science & Technology as per Norms of National Education Policy-2020 and as per Government Letter dated 13 March 2024 run at the Affiliated Colleges, Dr.Babasaheb Ambedkar Marathwada University as appended herewith.

Sr.No.	Courses	Semester
1.	B.Sc.Botany	Ist and IInd semester
2.	B.Sc.Biotechnology	Ist and IInd semester
3.	B.Sc.Zoology	Ist and IInd semester
4.	B.Sc.Agrochemical and Fertilizer	Ist and IInd semester
5.	B.Sc.Geology	Ist and IInd semester
6.	B.Sc.Environmental Science	Ist and IInd semester
7.	B.Sc.Home Science	Ist and IInd semester
8.	B.Sc.Diary Science and Technology	Ist and IInd semester
9.	B.Sc.Automobile Technology	Ist and IInd semester
10.	B.Sc.Physics	Ist and IInd semester
11.	B.Sc.Chemistry	Ist and IInd semester
12.	B.Sc.Analytical Chemistry	Ist and IInd semester
13.	B.Sc.Polymer Chemistry	Ist and IInd semester
14.	B.Sc.Electronics	Ist and IInd semester
15.	B.Sc.Forensic Science & Cyber Security	Ist and IInd semester
16.	B.Sc.Microbiology	Ist and IInd semester
17.	B.Sc.Fisheries Science	Ist and IInd semester
18.	B.Sc.Mathematics	Ist and IInd semester
19.	B.Sc.Forensic Science	Ist and IInd semester
20.	B.Sc.Information Technology	Ist and IInd semester
21.	B.Sc.Horticulture	Ist and IInd semester
22.	B.Sc.Networking & Multimedia	Ist and IInd semester
23.	B.Sc.Biochemistry	Ist and IInd semester
24.	B.Sc.Industrial Chemistry	Ist and IInd semester
25.	B.Sc.Bioinformatics	Ist and IInd semester

26.	B.Sc.Instrumentation Practice	Ist and IInd semester
27.	B.Sc.Non-Conventional and Conventional Energy	Ist and IInd semester
28.	B.Sc.Statistics	Ist and IInd semester
29.	Bachelor of Computer Application	
30.	B.Sc.Computer Science (Degree)	Ist and IInd semester
31.	B.Sc.Computer Science (Optional)	Ist and IInd semester

This is effective from the Academic Year 2024-25 and onwards.

All concerned are requested to note the contents of this circular and bring the notice to the students, teachers and staff for their information and necessary action.

University Campus, \*
Aurangabad-431 004. \*
REF.No.SU/2024/25389-36 \*
Date: 29.04.2024. \*\*\*

Deputy Registrar, Academic Section

# Copy forwarded with compliments to :-

- 1] The Principal of all concerned Colleges,
  Dr. Babasaheb Ambedkar Marathwada University,
- 2] The Director, University Network & Information Centre, UNIC, with a request to upload this Circular on University Website.

#### Copy to :-

- 1] The Director, Board of Examinations & Evaluation, Dr.Babasaheb Ambedkar Marathwada University, Chhatrapati Sambhajinagar.
- 2] The Section Officer, [B.Sc.Unit] Examination Branch, Dr.Babasaheb Ambedkar Marathwada University, Chhatrapati Sambhajinagar.
- 3] The Programmer [Computer Unit-1] Examinations, Dr.Babasaheb Ambedkar Marathwada University, Chhatrapati Sambhajinagar.
- 4] The Programmer [Computer Unit-2] Examinations, Dr.Babasaheb Ambedkar Marathwada University, Chhatrapati Sambhajinagar.
- 5] The In-charge, [E-Suvidha Kendra], Rajarshi Shahu Maharaj Pariksha Bhavan, Dr. Babasaheb Ambedkar Marathwada University, Chhatrapati Sambhajinagar.
- 6] The Public Relation Officer, Dr.Babasaheb Ambedkar Marathwada University, Chhatrapati Sambhajinagar.
- 7] The Record Keeper, Dr.Babasaheb Ambedkar Marathwada University, Chhatrapati Sambhajinagar.

# Dr. Babasaheb Ambedkar Marathwada University Chhatrapati Sambhajinagar- 431001



# B.Sc. Degree Programme

(Three Year / Four Years (Hons) /Four Years (Hons with Research)

underganding and cultivating real-artid skills. Through laboratory work, field experimens, indicate and project-based learning opportunities, madents will have the chance in apply

# Course Structure and Syllabus for B. Sc. 1st Year

(Revised)

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Subject (Major): Microbiology

so we embark so this iostney of educational transformation mided by the varianal

vision of a more equitable, inclusive, and enligheesed society. It is our harmonis academics, unavailed reduced, and unwavering de icition

Editionation Police, 2020, the Bachelet of Science (P. Sc.) cincronium stands as a test

Effective from 2024-25

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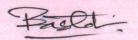
# Structure of B. Sc. (Three / Four Years Honours / Honours with Research Degree) Programme with Multiple Entry and Exit Options

Subject (Major): .....

# BSc First Year: 1st Semester

Course Type	Course Code	Course Name	Teaching (Hrs/W	Scheme /eek)	Credits A	Assigned	Total Credits
			Theory	Practical	Theory	Practical	LEY LESS THE
Major ( Core) M1 Mandatory	DSC-1/ MBN111	Fundamentals of Microbiology	2	iliani i	2	(36)	2+2 = 4
	DSC-2/ MBN 121	Practical based on DSC-1		4		2 (StA3)	() organic
Major (Core) M2	DSC-1		2		2	eton oyn	THE SECOND P.
Mandatory	DSC-2	Practical based on DSC-1	A A MINIST	4	MEN ST	2	2+2 = 4
Major (Core) M3	DSC-1		2	T-Verille	2	ा सारका मू	THE REPORTS
Mandatory	DSC-2	Practical based on DSC-1		4		2	2+2 = 4
Generic / Open Elective ( GE/OE) (Choose any two from pool of courses) It should be chosen compulsorily from	GE/OE-1/ MBN113	To be chosen from other faculty	2 2 mile trained less		2	med our	ERRORINO V 3 Elem 20 2 DER SECULIA ) EXTA TO HODE
the faculty other than that of Major	SEC-1/	1) Biosafety	A tolt drama (velue vel velue velue velue vel velue vel vel vel vel vel vel velue vel vel vel vel vel vel vel vel vel ve	ارتعا	1117	8.31	DHV 3.
( Skill Enhancement Courses)	MBN114	2) 11/4	allia di sala	-			2
(Choose any one from pool of courses)	MBN 115 SEC-2/ MBN 122	2) Water Analysis Practical based on SEC-1		2		9 m ) > 4	parino.
fit 40	AEC-1	English ( Common for all the faculty)	2	से अंग	2		
AEC, VEC, IKS	IKS-1	Choose any one from pool of courses	w and a series	Calufacility denound t	2	Grand ; as	2+2 =4
OJT/ FP/CEP/CC/RP	CC-1	Health and Wellness ( Common for all the faculty)	itoo zii(f)	) nortain	omes T.E	1 2 Co	0/30
			13	18	13	09	22

GE/OE -1: Microbial Biotechnology (This course will be available for the students from other faculty)



# BSc First Year: 2nd Semester

Course Type	Course	Course Name	Teaching (Hrs/W		Credits A	ssigned	Total Credits
	Code	Subject (M)	Theory	Practical	Theory	Practical	
Major ( Core) M1	DSC-3/ MBN 211	Microbial Techniques	2	TE W	2		2+2 = 4
Mandatory	DSC-4/ MBN 221	Practical based on DSC-3		4 751298		2 may teri	186 P
14 : ( Coro) M2	DSC-3	Secretary Court of	2		2		2+2 = 4
Major ( Core) M2 Mandatory	DSC-4	Practical based on DSC-3		4	Codes	2	2+2 = 4
Major (Core) M3	DSC-3		2	7-2-6-	2	A100.1	2+2 = 4
Mandatory	DSC-4	Practical based on DSC-3	Malejt	4	TITANIA	2	Z+Z-4
Generic / Open Elective (GE/OE)			2	DSC	2		2
(Choose any two from pool of courses) It should be chosen	GE/OE-2/ MBN 212	To be chosen from other faculty	to beind to	Practic	1-380 8-380	234 (	Constants of
compulsorily from					6080	ENA	402   10tpl-
the faculty other than that of Major			se beent la	pinant	D8C-2	35 30 934	Mendatory
VSC (Vocational Skill	VSC-1/ MBN 213	1) Pathology-1	1	1+3001	1	1	
Courses) (Choose any one from	MBN 214	2) Sustainable Agriculture - 1			GRADE		gis sepoil ()
pool of courses)	VSC-2/ MBN 222	Practical based on VSC-1	tuity	4	2		of blands fi
	AEC-1	English ( Common for all the faculty)	2			there Major	THE RESERVE AND DESCRIPTIONS
AEC, VEC, IKS	VEC-1	Constitution of India (Common for all the faculty)	2 make	18(1)	2 11203	heses	Sac Salas Balan Calasas
OJT/ FP/CEP/CC/RP	CC-2	Yoga Education / Sports and Fitness ( Common for all		4	MBR 118 SEC-20 MBN 1-2 ARG-1	No. of Concession, Name of Street, or other Designation, or other	The second secon
		the faculty)	13	18	13	09	22

Exit Option: Award of UG Certificate in 3 Majors with 44 credits and an additional 4 credits of core NSQF course
/ Internship OR continue with Major and Minor

GE/OE-2: Food Fermentation (This course will be available for the students from other faculty)

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Students will have to choose any three subjects as a Major 1, Major 2, Major 3, from Basket 1 under the Faculty of Science and Technology.

Students will be having three subject options of equal credits (instead of Major and / or minor verticals) in the first year. Students will have to select / declare choice of one subject as a major subject in the beginning of second year out of three major options M1, M2 and M3 (which were opted in the first year).

# Detailed Illustration of Courses included in 1st and 2nd semester:

- 1) Major (Core) subject are mandatory.
  - DSC-1: This is a 2 credit theory course corresponding to Major (core) subject
- DSC-2: This is a 2 credit practical course based on DSC-1
- DSC-3: This is a 2 credit theory course corresponding to Major (core) subject
  - DSC-4: This is a 2 credit practical course based on DSC-3
  - 2) Generic / Open Elective (GE/OE): (Needs to be chosen (any two) from pool of courses available at respective college). These courses should be chosen compulsorily from faculty other than that of Major.
    - GE/OE -1: This is a 2 credit theory course should be chosen compulsorily from faculty other than that of Major.
    - GE/OE -2: This is a 2 credit theory course should be chosen compulsorily from faculty other than that of Major.

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- 3) SEC (Skill Enhancement Courses): Choose any one from pool of courses. These courses needs to be designed to enhance the technical skills of the students in specific area.
  - SEC-1: This is a 1 credit theory course to enhance the technical skills of the students in specific area.
  - SEC-2: This is a 1 credit practical course based on SEC-1.
  - 4) VSC (Vocational Skill Courses): Choose any one from pool of courses. These courses should be based on Hands on Training corresponding to Major (core) subject.
    - VSC-1: This is a 1 credit theory course based Hands on Training corresponding to Major (core) subject.
    - VSC-2: This is a 1 credit practical course based on VSC-1
  - AEC (Ability Enhancement courses): The focus of these courses should be based on linguistic and communication skills.

AEC-1: English

This is a 2 credit theory course based on linguistic proficiency. It will be common for all the faculty.

AEC-2: English (Secretary Selection Responses to Account to the Secretary Se This is a 2 credit theory course based on linguistic proficiency. It will be common for all the faculty. The seems to the two they become to presented with or bestdue seems

- 6) IKS (Indian Knowledge System): The courses related to traditional and ancient culture of India will be included in this section. The respective college will have to choose one of the courses from the pool of courses designed by the University.
  - IKS-1: To be chosen from the pool of courses designed by the University This is a 2 credit theory course based on Indian Knowledge System. It will be common for all the faculty
- 7) VEC (Value Education Courses): The courses such as understanding India, Environmental Science / Education, Digital and Technological solutions etc will be part of Value Education Courses.

VEC-1: Constitution of India

This is a 2 credit theory course based on value education. It will be common for all Oh/OH -1: This is a 2 credit theory source should be chosen compulsorily

8) CC (Curricular Courses): The courses such as Health and wellness, Yoga education, Sports and Fitness, Cultural activities, NSS/NCC, Preforming Arts.

CC-1: Health and Wellness

This is a 2 credit practical course based on Co-curricular activities. It will be common SEC (Stall Enhancement Courses): Chance any one fift for all the faculty

CC-2: Yoga education / Sports and Fitness

This is a 2 credit practical course based on Co-curricular activities. It will be common SEX.AL: This is a Lonedit theory covered to estimate the for all the faculty

SEC-2 : This is a 1 credit renorded coorse heard on REC-1

# General Guidelines for Course Selection

1) The Major subject is the discipline or course of main focus, bachelors degree shall be awarded in that discipline / subject.

2) Students will have to choose any three subjects as a Major 1, Major 2, Major 3, from Basket 1 under the Faculty of Science and Technology (based on the available options in the respective college).

 Students will be having three subject options of equal credits (instead of Major and / or minor verticals) in the first year.

4) In the beginning of second year, students will have to select / declare choice of one major subject and one minor subject from three major options M1, M2 and M3 (which were opted in the first year)

5) Once the students finalize their Major Subject and Minor Subject in the beginning of the second year of the programme, they shall pursue their further education in that particular subject as their Major and Minor subjects. Therefore, from second year onwards curriculum of the Major and Minor subjects shall be different.

6) Students are required to select Minor subject from other discipline of the same faculty

7) Students are required to select Generic /Open Elective (vertical 3 in the credit framework) compulsorily from the faculty different than that of their Major / Minor subjects.

8) Vocational Skill Courses and Skill Enhancement Courses (VSC and SEC) shall be related to the Major subject

9) Curriculum of Ability Enhancement Courses (AEC), Value Education Courses (VEC), Indian Knowledge System (IKS), and Co-curricular Courses (CC) will be provided by the University separately.

organizations and communities. They will exhibit creativity, restlictor, and adaptability, betweening innovation to address complex challenges and selest opportunities for growth-

Catonal Cauxenshap and Caltural Sensitivity Craditates will present a plobal perspective and cultural sensitivity, recognizing the interconnectedness of diverse communities and the importance of collaboration across borders. They will degree in consequently dialogue, elaborate diversity, and contribute to the advancement of

These Programms Educational Objectives seems as guiding principles for the Bachelor of Science curriculum, reflecting the countries of maturals well-rounded graduates who are prepared in each in their expects, contribute to assistly, and lead meaningful fives in a

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# Programme Educational Objectives (PEOs):

Programme Educational Objectives (PEOs) for the Bachelor of Science Curriculum under the National Education Policy 2020:

General Guidelines for

- Mastery of Discipline-Specific Knowledge: Graduates of the Bachelor of Science program will demonstrate a deep understanding of fundamental principles, theories, and methodologies in their chosen scientific discipline, enabling them to analyze complex problems, propose innovative solutions, and contribute to advancements in their field.
- Interdisciplinary Proficiency: Graduates will possess the ability to integrate knowledge
  and skills from multiple scientific disciplines, fostering a holistic approach to problemsolving and innovation. They will be equipped to address multifaceted challenges by
  drawing upon diverse perspectives and methodologies.
- Critical Thinking and Analytical Skills: Graduates will develop strong critical
  thinking abilities, enabling them to evaluate information rigorously, analyze data
  effectively, and make informed decisions based on evidence. They will demonstrate
  proficiency in applying logical reasoning and scientific methods to solve problems and
  generate new knowledge.
- 4. Leadership and Innovation: Graduates will demonstrate leadership qualities and entrepreneurial mindset, capable of initiating and driving positive change in their organizations and communities. They will exhibit creativity, resilience, and adaptability, harnessing innovation to address complex challenges and seize opportunities for growth and advancement.
- 5. Global Citizenship and Cultural Sensitivity: Graduates will possess a global perspective and cultural sensitivity, recognizing the interconnectedness of diverse communities and the importance of collaboration across borders. They will engage in cross-cultural dialogue, embrace diversity, and contribute to the advancement of knowledge and understanding on a global scale.

These Programme Educational Objectives serve as guiding principles for the Bachelor of Science curriculum, reflecting our commitment to nurturing well-rounded graduates who are prepared to excel in their careers, contribute to society, and lead meaningful lives in a rapidly changing world.

# Programme Outcomes (POs):

The National Education Policy (NEP) 2020 for India emphasizes several key aspects for Bachelor of Science (B.Sc.) programs, aiming to produce graduates who are not only well-versed in their respective disciplines but also equipped with skills necessary for holistic development and employability. While specific program outcomes may vary between institutions and disciplines within B.Sc. programs, here are some common outcomes aligned with NEP 2020:

Penerganus Specific Outcomes (250s):

- ➤ PO1. The citizenship and society: Apply broad understanding of ethical and professional skill in science subjects in the context of global, economic, environmental and societal realities while encompassing relevant contemporary issues.
- PO2. Environment and sustainability: Apply broad understanding of impact of science subjects in a global, economic, environmental and societal context and demonstrate the knowledge of, and need for sustainable development.
  - PO3. Ethics: Apply ability to develop sustainable practical solutions for science subject related problems within positive professional and ethical boundaries.
  - > PO4. Individual and team work: Function effectively as a leader and as well as team member in diverse/ multidisciplinary environments.
  - ➤ PO5. Communication: Communicate effectively on complex science subject related activities with the scientific community in particular and with the society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
  - PO6. Project management and finance: Demonstrate knowledge and understanding of the first principles of science and apply these to one's own work as a member and leader in a team, to complete project in any environment.
  - PO7. Life-long learning: Recognize the need for lifelong learning and have the ability to engage in independent and life-long learning in the broadest context of technological change.

These program outcomes align with the broader goals of NEP 2020 to transform higher education in India and prepare students for the challenges and opportunities of the 21st century. Board of Studies designing B.Sc. curricula are encouraged to incorporate these outcomes into their program objectives and learning outcomes.

# Programme Specific Outcomes (PSOs):

PSO1. Domain knowledge: Acquire knowledge and gain understanding of concepts in microbiology and its applications in various fields.

Programme Outcomes (POR):

PSO2. Problem Analysis: Applying the knowledge acquired to explore the world of microbes and analysing the specific benefits.

PSO3. Design Development of solutions: Design/ develop solutions for problems at varied complexity in various areas of Microbiology to address changing challenges in various industries and environment thereby developing keen interest in research.

PSO4. Conduct Investigation of complex problems: Use established knowledge and methods to design of experiments, analyze resulting data statistically and interpret the same to provide valid conclusions for applied research.

PSO5. Modern tools: Create, select, and apply appropriate techniques, resources, and relevant IT tools including prediction and modelling to complex related activities with clear understanding of the limitations for solving real world problems.

2 PVIS. Ethics: Apply ability to develop againmable practical solutions for science

POA, fadistitud and team world: Function effectively as a faster and as well as

POS. Communications Communicate effectively on complex science subject related activities with the scientific community in particular and with the switch at large such as being able to commenced and write effective resorts and design

POG. Project management and finance: Demonstrate knowledge and understanding

FO7. Life-long learning: Recognize the need for lifelong scarring and have the

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# DSC-1/MBN 111: Fundamentals of Microbiology

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Total Credits: 02

Total Contact Hours: 30 Hrs

Maximum Marks: 50

# Learning Objectives of the Course:

The students will gain knowledge about the Development of Microbiology as a scientific discipline, also they will know the principles of microscopy, taxonomy and kinds of different microorganisms.

# Course Outcomes (CO's)

After successful completion of this course, students are expected to:

CO1: Understanding the History of Microbiology: Gain knowledge on Historical perspectives of Microbiology.

CO2: Microscopy Techniques: understand the concepts of Microscopy and get acquainted to various microscopic methods.

CO3: Taxonomy and Classification: Understand the concept of taxonomy, familiarize with classification systems and characteristics of bacteria used for classification.

CO4: General Characteristics of Microorganisms: Know general features of various kinds of microorganisms

Module No.		Contact Hours
Ι	History and Scope of Microbiology:  a. Definition and concepts b. Discovery of microorganisms: Contribution of Antony Van Leeuwenhoek. c. Spontaneous generation theory: Aristotle's view, Charles Darwin view. Controversy over spontaneous generation e. Recognition of the microbial role in diseases: Koch's postulates, a. Aseptic surgery & Pure culture concept f. Discovery of microbial effects on organic and inorganic matter. g. Recognition of the microbial role in fermentation: Contribution of Louis Pasteur	10 Hrs
п	Microscopy:  a. Introduction of Magnification, resolving power, depth of focus, focal length, numerical aperture.  b. Principle, Ray Diagram and Working of ( (Phase contrast microscope, Dark field microscope, Fluorescence Microscope, SEM and TEM).	10 Hrs
Ш	Taxonomy of microorganisms.  a. Taxonomic rank.  b. Major characteristics used in taxonomy (Morphological, Physiological, Immunological, Metabolic). Compositions of proteins, Composition of nucleic acids, Nucleic acids hybridization, Nucleic acid sequencing, 16S rDNA.  c. Classification system d. Numerical taxonomy. e. Bergey's manual of systematic Bacteriology, General characteristics enlisting all parts with major characters and examples in brief. f. General characteristics of Microorganisms in brief (Fungi, Algae, Actinomycetes, Mycoplasma, Rickettsia, Archaebacteria, Protozoa, Viruses)	10 Hrs

Text Books:

- 1. Dubey RC and Maheswari D K "A text of Microbiology" (2012)
- 2. Powar C B and Daginawala H F. "General Microbiology volume 1 and 2"
- 3. Geeta Sumbali and Mehrotra RS "Principles of Microbiology" (2009)

Taxonousy and Classifications (Inderstand the concept of tax-'gomy

# Reference Books:

- 1. Hans G. Schlegel. "General Microbiology"
- 2. R.Y. Stayner "General Microbiology".
- 3. Crabtree, & Martin Frobisher "Fundamentals of Microbiology".
- 4. A.J. Salle "Fundamentals of Bacteriology"
- 5. Robert F Boyd (1984). General microbiology.
  - 6. Prescott L M, J P Harley and D A Klein "Microbiology".
  - 7. Ingraham J.L. and Ingrahm C.A "Introduction to Microbiology"

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Fig. 1. Topics / actual contents of the syllabor.

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E. Acceptation of the microbial role or diseases Rock's postulates.

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E. Discovery of microbial role or description and inorganic matter.

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Taxonomy of microscops, (Negatification, Control of the field microscops.)

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# DSC-2/MBN 121: Lab Course based on MBN 111

Total Credits: 02

Total Contact Hours: 60 Hrs

Maximum Marks: 50

#### Learning Objectives of the Course:

- i) The students will Get acquainted with many microbiological instruments.
- ii) They will develop understanding of basic microbiological experimental procedures.
- iii) They will acquire understanding of sterilization, incubation, inoculation etc..

# Course Outcomes (COs):

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

CO1: Gain knowledge on Historical perspectives of Microbiology

CO2:Understand the concepts of Microscopy and get acquainted to various microscopic methods

CO3:Understand the concept of taxonomy, familiarize with classification systems and characteristics of bacteria used for classification.

CO4:Know general features of various kinds of microorganisms

Module No.	Topics / actual contents of the syllabus	Contact Hours
ome one of the year of the yea	<ol> <li>Microscopy- Different parts of compound microscope. Use and care of compound microscope.</li> <li>Preparation of Standard Operating Procedures (SOPs) for common microbiology laboratory instruments: Introduction to Laboratory equipment, Construction, Operation and utility of laboratory equipment.</li> <li>Autoclave 6 Colorimeter/Spectrophotometer</li> <li>Hot air oven 7 Anaerobic jar</li> <li>Incubator 8 Seitz filter</li> <li>pH meter 9 Laminar air flow</li> <li>Centrifuge</li> </ol>	nog to se onews o
THE STREET	Staining methods: Monochrome, Negative and Gram's staining     Disinfection & discarding techniques in laboratory     Introduction of: Wire loop, Agar, Agar slant apparatus, Incubators,     Pasteurization, Radiations	10 Hrs
Ш	Study tour to related laboratories /industries	10 Hrs

# Text Books:

- 1. Aneja, K. R. "Experiments in Microbiology" 3rd edition, Wishwa Prakashan, NewDelhi (1996)
- Parija, S. C.. "Textbook of Practical Microbiology, 1st edition, Ahuja Publishing House, New Delhi. (2005)

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- Atlas, R. M. (1997). Principles of Microbiology, 2nd edition, W. M. T. Brown Publishers.
- Cappucino, J. & Sherman, N. (2010). Microbiology: A Laboratory Manual, 9th edition, Pearson Education Limited, New Jersey.
- 3. Prescott L M, J P Harley and D A Klein "Microbiology".
  - 4.Ingraham J.L. and Ingrahm C.A "Introduction to Microbiology"

# SEC -1/MBN 113 : Biosafety

Total Credits: 01

Total Contact Hours: 15 Hrs

Maximum Marks: 50

# Learning Objectives of the Course:

The students will gain knowledge about the various biotechnological concepts viz:

- Biosafety guidelines, and an analysis to endownershop endown the i.
- Biohazards, ii.
- iii. GMO,
- Risk analysis etc. iv.

# Course Outcomes (COs):

On completion of the course, students shall be able to:

CO1: Understanding Biosafety Principles: Students will develop a comprehensive understanding of the principles and importance of biosafety in laboratory and industrial settings. They will learn about the risks associated with biological materials and the need for containment measures.

CO1: Biohazard and Biosafety Levels: Students will become familiar with the classification of biohazards and the guidelines and regulations for working with different types of biological agents, including bacteria, viruses, genetically modified organisms, and toxins.

CO3: GMOs and LMOs: Students will understand the principles and regulations surrounding the use of genetically modified organisms (GMOs) and living modified organisms (LMOs). They will be aware of the ethical, environmental, and regulatory considerations associated with GMOs and

CO4: Risk Assessment: Students will be able to conduct risk assessments to determine the potential hazards associated with specific biological materials, research projects, or

Module No.	Topics / actual contents of the syllabus	Contac Hours
gril 01	Biosafety: Introduction; History, biosafety issues in Microbiology, Mol. Biology, biotechnology; Biological Safety Cabinets & their types; Primary Containment for Biohazards; Biosafety Levels of Specific Microorganisms	5 Hrs
п	Biosafety Guidelines Biosafety guidelines and regulations (National and International); GMOs/LMOs- Concerns and Challenges; Role of Institutional Biosafety Committees (IBSC), RCGM, GEAC etc. for GMO applications in food and agriculture; Environmental release of GMOs;	5 Hrs
Ш	Risk Analysis; Risk Assessment; Risk management and communication; Overview of International Agreements - Cartagena Protocol.	5 Hrs

# Text Books:

Reference Books:

1. Introduction to Plant Biotechnology, H S Chawla 2. M K Sateesh.

2. Bioethics and Biosafety. Kindle Edition 3. Shomini Parashar, Deepa Goel IPR, Biosafety and Bioethics Pearson India 2013

# SEC -1/MBN 114 : Water Analysis

Total Credits: 01

Total Contact Hours: 15 Hrs

Maximum Marks: 50

# Learning Objectives of the Course:

The students will gain knowledge about the various biotechnological concepts viz:

i. Understand water quality parameters.

ii. Learn the physical, chemical and biological characteristics.

# Course Outcomes (COs):

CO1: Students will gain knowledge related to water microbiology, properties and standard quality of water. They will also learn the various water borne diseases.

CO2: will get to know the various methods used in water sample collection/treatment and the different tests for determining the quality of water.

Module No.	Topics / actual contents of the syllabus	Contact Hours
I TOP	Water Microbiology	pality stage
postuo.	Water as a major component of environment. Types, properties, and uses of water. Microorganisms of different water bodies. Standard qualities of drinking water.	5 Hrs
	Water borne pathogens & diseases: Shigella, E. coli, Vibrio, Salmonella, Rotavirus, Entamoeba.	
ENH OF	Water Analysis	
п	Microbiological Analysis of Water Sample Collection, Treatment, and safety of drinking (potable) water, methods to detect potability of water samples: (a) standard qualitative procedure: presumptive/MPN tests, confirmed and	5 Hrs
	completed tests for faecal coliforms (b) Membrane filter technique and (c) Presence/absence tests	(ext Bac
Щ	Water for pharmaceutical use- types of water- potable water, water for injection, water for preparation of extracts, Water used for cleaning/rinsing of equipment, containers and closures	5 Hrs

# Text Books: When the mount has resided and the body application

- Brock Biology of Microorganisms. 14th edition. Madigan MT, Martinko JM and Parker J. (2014) Pearson/ Benjamin Cummings
- Environmental Microbiology. 2nd edition, Maier RM, Pepper IL and Gerba CP. (2009).
   Academic Press.
- Environmental Microbiology of Aquatic & Waste systems. Okafor, N (2011). 1st edition, Springer, New York.
- 4. USP 1231 & ISO 10500 EPA guidelines

# SEC 2/MBN 122 : Biosafety (Practical Based on MBN113)

Total Credits: 01

Total Contact Hours: 30 Hrs

Maximum Marks: 50

# Learning Objectives of the Course:

The students will gain knowledge about;

- i. The biosafety guidelines,
- ii. Biohazards,
- iii. GMO,
- iv. Risk analysis by using personal protective equipments.

# Course Outcomes (COs):

CO1: Understanding Biosafety Principles: Students will get to know the importance of biosafety in laboratory and industrial settings. They will learn about the risks associated with biological materials and the need for containment measures through properly handling of lab equipment.

CO2: Biohazard and Biosafety Levels: Students will become familiar the guidelines and regulations for working with different types of biological agents, including bacteria, viruses, genetically modified organisms, and toxins.

CO3: Disposable lab consumables: Simultaneously students will get to know the proper disposal of lab consumables.

Module No.	Topics / actual contents of the syllabus	Contact Hours
	<ul> <li>a. Personal safety in Laboratory using Personal Protective Equipment</li> <li>b. Biosafety: Handling of Pipette while pipetting /glassware, Hazardous Chemicals</li> </ul>	
I	<ul> <li>c. Pre and Post care while handling the Pathogens.</li> <li>d. Precautions while handling lab equipments such as blender, centrifuge, inoculating loops, absorbent cotton.</li> <li>e. Proper use and removal of potentially contaminated gloves and disposal of lab consumables.</li> </ul>	30 Hrs

#### Text Books:

# Reference Books:

5. Brock Biology of Microorganisms. 14th edition. Madigan MT, Martinko JM and Parker J. (2014) Pearson/ Benjamin Cummings

Water for plummatentical uses 190cs of waters pota

- 6. Environmental Microbiology. 2nd edition, Maier RM, Pepper IL and Gerba CP. (2009).

  Academic Press.
- Environmental Microbiology of Aquatic & Waste systems. Okafor, N (2011). 1st edition, Springer, New York.
- 8. USP 1231 & ISO 10500 EPA guidelines

SEC 2/MBN 123: Water Microbiology (Practical Based on MBN114)

bis course will be available for the students from other facuity

Total Credits: 01 Total Contact Hours: 30 Hrs

Maximum Marks: 50

Learning Objectives of the Course:

Understand water quality parameters by performing practical in laboratory.

Course Outcomes (COs):

CO1: Students will gain knowledge related to water microbiology, properties and standard quality of water by performing various test in laboratory.

CO2: Will get to know the various methods used in water sample collection/treatment and the different tests for determining the quality of water.

Module No.	Topics / actual contents of the syllabus	Contac
al based	1. Microbiological examination of water (Drinking water, Supply water, Pondwater and Sewage):	nibube la co
	a) Presumptive test b) Confirmatory test c) Completed test: for coliform ii)	roducis.
House	IMViC reaction.  2. MPN	30 Hrs
	3. Measurement of TDS is water and ORP	

# Text Books:

# Reference Books:

- Brock Biology of Microorganisms. 14th edition. Madigan MT, Martinko JM and Parker J. (2014) Pearson/ Benjamin Cummings
- Environmental Microbiology. 2nd edition, Maier RM, Pepper IL and Gerba CP. (2009). Academic Press.
  - Environmental Microbiology of Aquatic & Waste systems. Okafor, N (2011). 1st edition, Springer, New York.
  - 12. USP 1231 & ISO 10500 EPA guidelines

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Storobial Technology oil and II by Poplar

# This course will be available for the students from other faculty

GE/OE -1/MBN 112 : Microbial Biotechnology

Total Credits: 02 Total Contact Hours: 30 Hrs

ourse Oussessus (COs)

Maximum Marks: 50

# Learning Objectives of the Course:

The students will gain knowledge about the various biotechnological concepts viz: microbial products, and total and college games are well resonantly value as the force of

- GEMs, ii.
- bioprocess, iii.
- downstream processing etc. iv.

# Course Outcomes (COs):

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

CO1: Microbial Diversity and Functionality: Students will gain an understanding of the diverse microorganisms used in biotechnology and their specific functions. This includes knowledge of bacteria, fungi, and viruses and their roles in bioprocessing and bio-product development.

CO2: Bioprocess Engineering: Students will learn the principles of bioprocess engineering, including fermentation techniques and optimization of microbial growth conditions.

CO3: Bioproduct Development: Students will be able to develop and evaluate microbial-based products.

Module No.	Topics / actual contents of the syllabus	Contact Hours
1	Microbial Biotechnology and its Applications     Microbial biotechnology: Scope and its applications in human therapeutics, agriculture (Biofertilizers, PGPR, Mycorrhizae), environmental, and food technology.     Use of prokaryotic and eukaryotic microorganisms in biotechnological applications Genetically engineered microbes for industrial application: Bacteria and yeast.	10 Hrs
II POO	Downstream processes  Microbial product purification: filtration, ion exchange & affinit chromatography techniques, Immobilization methods and the application: Whole cell immobilization	10 Hrs
III	A. Microbes for Bioenergy     Bio-ethanol and bio-diesel production: commercial production from lignocellulosic waste and algal biomass, Biogas production: Methane and hydrogen production using microbial culture.      B. Regulatory     Patents, Copyrights, Trademarks, Publication of Research	10 Hrs

- Biotechnology: Rehm and Reid.
- Comprehensive biotechnology: Murray Moo Young.
- 3. Microbial Technology vol I and II by Pepler
- 4. Microbiology and technology of fermented foods: R. W. Hutkins Blackwell publishing

	DSC-3/MBN 3111 Migrabial Lechniques	
	Total Contact Hours, 30 H	riban) less
	Maximum Marks 10	
	Objectives of the Course.	Sandarana 1
	will team knowledge about the various mismobiological rechniques vix	physicata ar
	And the second s	
	interiors of pure culture.	
	remain (COs):	
	the completion of this course, students are expected to explosion that	PLOOM ANDORA
	said explain the key concepts of accilization and disinfection, including types of	action into
	epoctrum of activity, mode of action, and applications	
	oure culture lechniques to isoniti, a numerate, and cultivate microorganisms, usin	COIL Apply
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	to and interpret commen staming procedures for the microscopic observation of	ing a term
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	Sterilization, Distribuction, Germicide, Antiseptics, Becteriossalia,	
	and a little of	
	BSc First Year: 2nd Semester	
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	i Dry Heat- Hot air oven, Incincration  (i http://execurization.Canning, Boiling, Autoclaving	
	L Dry Hear-Hot air oven, Incineration  (i. Moist Hear-Pesteurization, Canning, Boiling, Autoriaving  c Chemical stantaring agents: Spectrum, Mode of action,	
	i Dry Heat-Hot air oven, Incincration ii Moist Heat-Pasteurization, Canning, Boiling, Autorlaving c Chemical sterilizing agents; Spectrum, Mode of action, Application, Limitations with one example of each	
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	i Day Heat-Hot air oven, Incinoration  (i Moist Heat-Pasteurization, Canning, Boiling, Autorlaving  o Chamical sterilizing agents; Spectrum, Mode of action, Application, Limitations with one example of oach  it. Phenolius, it. Archols, it. Heavy metalis, vv. Heavy metalis, vi. Compounds, Aldehvites, vii. Compounds, Aldehvites, viii. Canes-Sulfur dioxide, Ethylepe oxide and fi propiniscipals. Pure Culture Techniques.	
	i Day Heat-Hot air oven, Incineration  (i htmist Heat-Pasteurization, Canning, Boiling, Autoclaving  (i) Application Limitations with one example of action,  ii Phenolius,  iii thalogens,  iv Heavy metals,  v Ousternary sumonium,  vi Compounds, Aidehvides  vi Compounds, Aidehvides  vi Compounds, Aidehvides  Vire Culture Fetherques  Pure Culture Techniques  (compounds and significance)	
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vii 01	In Moist Heat- Hot air oven, Incinoration  (I Moist Heat- Pasteurization, Canning, Boiling, Autorlaving of Cannical stantians agents, Spectrum, Mode of action, Application, Limitations with one example of each in Archols, in Alcohols, in Alcohols, it Heavy metals, it is lialogens, v. Compounds, Aldahvites, v. Compounds, Aldahvites, vi. Compounds, Aldahvites, vii. Compounds, Aldahvites, and the incinoration of pure culture.  Pure Californ Techniques  Strend pinte method.  Strend pinte method.  Hastes of cultivation of nite method.  A. Propounds of a good culture medium.	
vii 01	Environ Hot ar over, Incincration  (i) Mora Hear Pesteurization Caming, Boiling, Autoclaving  (ii) Cagnical sterilaring agents: Spectrum, Mede of action, Application, Limitations with one example of cach  iii. Incident, iii. Incident, iii. Incident, iv. Heavy merals, v. Obstemmy summonium, vi. Compounds, Aidehvides  vi. Compounds, Aidehvides  Pure Calrers Suhin dioxide, Rünylene oxide and proposite tone  ii. Cances Suhin dioxide, Rünylene oxide and proposite tone  b. Methods for isolation of pure culture  ii. Pour plate method  ii. Pour plate method  iii. Pour plate method	7
vii o	(i) Notice Heat Perseurization Canning, Boiling, Autorlaving (i) Repriced plantizing agencies Spectrum, Mode of action, Application, Limitations with one example of oach is Phenodius, in Atoriols, in Heavy metalis, iv Heavy metalis, v) Ossternary anumanium, vi Compounds, Aldahvides, vi Compounds, Aldahvides, vii, Cances Sulfru dioxide, Rithylene oxide and \$ propintections  Pure Culture Techniques  i Nethods for isolation of pure culture  Street, riske method in Surent riske method in Surent plate method in Preparates and suppleations in Chiefers in culture media	
vii o	[ ] Wy Heat Hot ar over, Incineration [ ] Moist Heat Pesteurization Canning, Boiling, Autorlaving [ ] Chemical stendining agents: Spectrum, Moste of action, Application, Limitations with one example of each [ ] Phenolius,	7
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# DSC-3/MBN 211: Microbial Techniques

Total Credits: 02

Total Contact Hours: 30 Hrs

Maximum Marks: 50

# Learning Objectives of the Course:

The students will gain knowledge about the various microbiological techniques viz:

- Sterilisation, i.
- Development of pure culture, ii.
- Enumeration of microorganisms etc. iii.

# Course Outcomes (COs):

After successful completion of this course, students are expected to:

CO1: Define and explain the key concepts of sterilization and disinfection, including types of agents, spectrum of activity, mode of action, and applications.

CO2: Apply pure culture techniques to isolate, enumerate, and cultivate microorganisms, using a variety of culture media and methods.

CO3: Perform and interpret common staining procedures for the microscopic observation of Microorganisms.

Mic	roorganisms.	
Module No.	Topics / actual contents of the syllabus	
	Sterilization and Disinfection a. Definition and Concept:	
	Sterilization, Disinfection, Germicide, Antiseptics, Bacteriostatic,	300
	Bactericidal  b. Physical Sterilizing agents:	
7 4 7		
	i. Dry Heat- Hot air oven, Incineration	
ALC: EN	ii. Moist Heat- Pasteurization, Canning, Boiling, Autoclaving	172576
	c. Chemical sterilizing agents: Spectrum, Mode of action,	
	Application, Limitations with one example of each	
	i. Phenolics,	
1	ii. Alcohols,	10 Hrs
	iii. Halogens,	
	iv. Heavy metals, v. Quaternary ammonium,	To the second
	vi. Compounds, Aldehydes.	
No.	vii. Gases- Sulfur dioxide, Ethylene oxide and β propiolactone.	
	Pure Culture Techniques	
	a. Definition and significance	1. 70.00
100	b. Methods for isolation of pure culture-	
	i. Streak plate method,	
	ii. Pour plate method,	
	iii. Spread plate methods.	
E E STATE	Basics of cultivation of microorganisms	
	a. Properties of a good culture medium.	
139	b. Agar: Properties and applications	10 Hrs
II	c. Role of Buffers in culture media	io mis
	d. Definition and concept	
	i. Living media: Embryonated chicken eggs, Tissue culture     ii. Non-living media: Natural, Semi-synthetic & Synthetic	14000
	11. Non-living media: Natural, Schii-Synthetic & Bytthetic	

A NOTE OF STREET		A STATE OF THE STA
	e. Types of culture media based on their specific use w.r.t. role of	
	media ingredients (with example of each type), Selective,	
	Differential, Enriched, Enrichment, Assay, Minimal, Maintenance &	
	Transport media.	on's last
1	f. Cultivation of anaerobes (two methods)	and the
	i. Candle jar method	Winter on
	ii. Anaerobic jar Method	24 /3
	Stains and Staining Methods	CONTRACTOR OF THE PARTY OF THE
	a. Definition: Stain, Dye, Chromogen, Chromophore, Auxochrome,	SOFT FLO
	Acidic stain, Basic stain, Staining reagent: Primary stain, Secondary	A DETTON
1-11	stain, Mordant and Decolourizer	COMPANIE SHAPE
	b. Fixation of smear: Physical and Chemical methods	303
	c. Physico-chemical basis of staining.	002
1	d. Staining methods: Principle, application and methodology	103
III	i. Simple Staining: Monochrome and Negative staining	10 Hrs
Contact	ii. Differential staining: Gram's and Acid-fast staining	Sledani
Hours	iii. Structural/Special staining: Cell wall, Capsule, Spore,	a con
-	Flagella	
	iv. Staining of fungi	1
	Techniques for enumeration of microorganisms:	
	a. Direct: Direct Microscopic Count, Colony count,	
WELL DE	b. Indirect: Measurement by turbidometry, cell mass	1
	o. marcot. Ficusarement by tarondometry, cen mass	

#### Text Books:

- 1. Dubey RC and Maheswari D K "A text of Microbiology" (2012)
- 2. Powar C B and Daginawala H F. "General Microbiology volume 1 and 2"
- 3. Geeta Sumbali and Mehrotra RS "Principles of Microbiology" (2009)

- 1. Microbiology Principle and Explorations; Jacquelyn G. Black, John Willey & Sons,
- Microbiology; Tortora, Funke, Case, Pearson Education India
   Prescott's Microbiology; McGraw Hill
- 4. Brock Biology Of Microorganisms, Microbiology; Madigan Michael T., Pearson
- 5. A Textbook of Microbiology: R.C. Dubey & D.K. Maheshwari, S Chand & Co. Ltd.
- 6. Microbiology: Fundamentals and Applications; S.S. Purohit, Agrobios (India)
- 7. Fundamental Principles of Bacteriology; A.J. Salle, Tata McGraw-Hill Publishing Company Ltd.
- 8. Microbiology: Michael J. Pelczar, E.C.S. Chan, Noel R. Krieg, McGraw Hill Education
- 9. Handbook of Media, Stains and Reagents in Microbiology: A.M. Deshmukh, Oxford
- 10. A Handbook of Elementary Microbiology: H.A. Modi, Shanti Prakashan
- 11. A Text book of Microbiology; Kanika Sharma, Ane Books Pvt., Ltd.
- 12. General Microbiology volume 1 and 2 by Powar CB and Daginawala, Himalaya **Publishing House**
- 13. Experiments in Microbiology, Plant Pathology, Tissue Culture and Microbial Biotechnology; K.R. Aneja, New Age International Private Limited
- 14. Microbiology; Dr. R.P. Singh, Kalyani Publishers

# DSC-4/MBN 221 : Lab Course based on MBN 211

Total Credits: 02 Total Contact Hours: 60 Hrs

Maximum Marks: 50

#### Learning Objectives of the Course:

- i) The students will Get acquainted with many microbiological instruments.
- ii) They will develop understanding of basic microbiological experimental procedures.
- iii) They will acquire understanding of bacterial staining procedures

# Course Outcomes (COs):

After successful completion of this course, students are expected to:

- CO1: Stain the bacterial structures using special staining techniques.
- CO2: Able to prepare different cultivation media for microorganisms.
- CO3: Enumerate microflora from different ecological samples.
- CO4: Validate and evaluate instruments and disinfectant.

CU4.	validate and evaluate instruments and disinectant.	222	
Module No.			
	Structural staining: grant to symmetre vi	1	
	i. Cell wall staining (Chance's method)		
I	ii. Capsule staining (Maneval's method)	10 Hrs	
	iii. Spore staining (Schaeffer and Fulton's method) iv. Bacterial Flagella staining (Patel, Kulkani & Gaikwad's method)	008 Bb	
"S bo	Hanging drop technique.		
	Measurement of size of cells by micrometry		
II	Preparation of cultivation Media	10 Hrs	
	i. Nutrient Broth & Agar	יכולפרפונו	
t Sorts.	ii. MacConkeys Broth and Agar iii. Potato Dextrose Agar	M (	
Ш	Cultivation of Microoganisms from Air, water and Soil	10 Hrs	

#### Text Books:

- 1. Aneja, K. R. "Experiments in Microbiology" 3rd edition, Wishwa Prakashan, NewDelhi (1996)
- Parija, S. C.. "Textbook of Practical Microbiology, 1st edition, Ahuja Publishing House, New Delhi. (2005)

# Reference Books:

- Atlas, R. M. (1997). Principles of Microbiology, 2nd edition, W. M. T. Brown Publishers
- Cappucino, J. & Sherman, N. (2010). Microbiology: A Laboratory Manual, 9th edition, Pearson Education Limited, New Jersey.
- 3. Prescott L M, J P Harley and D A Klein "Microbiology".
- 4. Ingraham J.L. and Ingrahm C.A "Introduction to Microbiology"

Experiments in Microbiology, Plant Pubelogy, Thing Officer etc.
Secretinology, L.E. Ange, New Age Interpretational Provide Lieuwe

VSC-1/MBN 213 : Pathology

Total Credits: 01 Total Contact Hours: 15 Hrs

Maximum Marks: 50

# **Learning Objectives:**

The students will gain knowledge about the haematology, RBC &WBC counts, DLC etc.

# Course Outcomes (CO's)

After successful completion of this course, students are expected to:

CO1: Understanding Hematological Basics: Students will develop a fundamental understanding of the components of blood, including red blood cells, white blood cells, platelets, and plasma. They will learn about the structure and function of these blood components.

CO2: Blood Testing and Analysis: Students will learn how to perform basic hematological tests, interpret results from tests like complete blood counts (CBC), and understand the significance of different blood parameters in diagnosing and monitoring hematological conditions.

CO3: Clinical Applications: Students will be introduced to the clinical applications of basic hematology in healthcare settings. They will understand the role of hematology in disease diagnosis, patient care, and treatment

Module No.	Topics / actual contents of the syllabus			
	Introduction of hematology	11		
	a. Formation of Blood			
SHITS	b. Erythropoiesis	5 Hrs		
	c. Educoporesis and Indiana and American State Inc. Maria	1111		
	d. Thrombopoiesis			
	Hematological Techniques –I	oull tax		
П	a. Collection of Blood	5 Hrs		
	b. Anticoagulants			
New	RBC & WBC and all and a state of the state o	bandald		
ш	a. Red cell count – Hemocytometer, Methods and Calculation	5 Hrs		
	b. WBC Count Methods	JAMES		
	c. Differential Leucocytes Count (DLC)	Subba F		
	d. Morphology of White Cells, Normal Values, Hb.			

#### Text Books:

- 1. Modern Medical Laboratory Technology: Methods & Interpretation by Ramnik Sood
- Hematology for students practitioners including practical hematology 7<sup>th</sup> Ed. by Ramnik Sood
- 3. Text Book of Medical Laboratory Technology by Ramnik Sood
- 4. Clinical Pathology, hematology and blood banking by Nanda Maheshwari
- Blood banking and transfusion medicine-Basic principles and practice by Christopher D.,
   Hill Yeretal, Publishers: Churchile Livingstone, Philadelphia
- 6. Practical Hematology by Sir John Dalie, Publisher Churevill, London
- 7. Textbook of Pathology by Robbins.
- 8. Textbook of General Pathology Part I & II by Bhende and Deodhare.
- 9. Textbook of Pathology by Harsh Mohan.
- 10. IAPM textbook of Pathology.

VSC -1/MBN 214 : Sustainable Agriculture

Total Credits: 01 Total Contact Hours: 15 Hrs

Maximum Marks: 50

Learning Objectives:

The students will understand impact of conventional agriculture and will learn to develop strategies to reduce pollution, greenhouse gas emissions, minimize agriculture's environmental footprints.

# Course Outcomes (CO's)

After successful completion of this course, students are expected to:

CO1: Understanding properties of Soil: Gain knowledge on soil fertility, plant nutrition from the perspectives of Microbiology.

CO2: Biofertilizers: understand the concepts of various biofertilizers used and get acquainted to various microbes involved in PGPR.

Module No. Topics / actual contents of the syllabus		Contac Hours
I	Concept of biofertilizers, their types, and their role in enhancing soil fertility and plant nutrition. Various production methods for biofertilizers, including composting, vermicomposting, and the use of microbial cultures.	5 Hrs
п	Plant growth promoting bacteria, biofertilizers – symbiotic ( <i>Bradyrhizobium</i> , <i>Rhizobium</i> , <i>Frankia</i> ), Non-Symbiotic ( <i>Azospirillum</i> , <i>Azotobacter</i> , Mycorrhizae, MHBs, Phosphate solubilizers, algae), Novel combination of microbes as biofertilizers. PGPRs	FILL
ш	General account of the microbes used as biofertilizers for various crop plants and their advantages over chemical fertilizers.	5 Hrs

#### Text Books:

# Reference Books:

1. Mahendra K. Rai (2005). Handbook of Microbial biofertilizers, The Haworth Press, Inc. New

York.

Subba Rao N.S (1995) Soil microorganisms and plant growth Oxford and IBH Publishing Co.

a. Rad call count - Hemodytometer, Medicula and Calculation

desphology of White Cells, Normal Values, 185.

Clinical Pathology, homanology and blood banking by Nanda Maheabwari

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Featbook of General Paladony Part J. It by Blacade and Daoith

Pvt. Ltd. New Delhi.

Aggarwal SK (2005) Advanced Environmental Biotechnology, APH publication

# VSC-2/MBN 222 : Pathology (Practicals Based on MBN213)

Total Credits: 01 Total Contact Hours: 30 Hrs

Maximum Marks: 50

# Learning Objectives:

The students will get acquainted with various pathological procedures like handling of instruments, staining blood samples. WBC measurements etc.

# Course Outcomes (CO's)

After successful completion of this course, students are expected to:

CO1: will collect the blood.

CO2: They will get to know the different techniques for counting the RBC and WBC.

CO3: measure Hb estimation from blood samples.

Module No.	Topics / actual contents of the syllabus	Contact Hours
Contact	<ul> <li>b. Collection of Blood (Demonstration only)</li> <li>c. Red cell count – Hemocytometer, Methods and Calculation</li> </ul>	Nebo)
I	d. WBC Count – Methods e. Differential Leucocytes Count (DLC)  f. Hb estimation	30 Hrs

#### Text Books:

- Modern Medical Laboratory Technology: Methods & Interpretation by Ramnik Sood
- Hematology for students practitioners including practical hematology 7<sup>th</sup> Edition by Ramnik Sood
- 3. Textbook of Medical Laboratory Technology by Ramnik Sood
- 4. Clinical Pathology, hematology and blood banking(For DMLT students) by Nanda Maheshwari
- Blood banking and transfusion medicine-Basic principles and practice by Christopher D., Hill Yeretal, Publishers: Churchile Livingstone, Philadelphia
- 6. Practical Hematology by Sir John Dalie, Publisher Churevill, London

# VSC 2/MBN 223: Sustainable Agriculture (Practicals Based on MBN214)

Total Credits: 01

Total Contact Hours: 30 Hrs

Maximum Marks: 50

# Learning Objectives:

The students will get acquainted with various isolation procedures for rhizobacteria, handling of various instruments.

# Course Outcomes (CO's)

After successful completion of this course, students are expected to:

CO1: Students will now the various isolation techniques for Nitrogen fixation and phosphate solubilizing bacteria.

CO2: They will get to know the about siderophores in plant growth promotion and biocontrol.

CO3: students will get hands on training for production of biofertilizers and vermicomposting.

Module No.	Topics / actual contents of the syllabus	Contact Hours
	Isolation of plant growth promoting rhizobacteria     a. nitrogen fixing.	
I	b.siderophore producing. c.phosphate solubilizing.	30 Hrs
	2. Lab Scale Production of biofertilizers and vermicomposting,	Refe

#### Text Books:

# Reference Books:

- 1. Mahendra K. Rai (2005). Handbook of Microbial biofertilizers, The Haworth Press, Inc. New
- York.
- 2. Subba Rao N.S (1995) Soil microorganisms and plant growth Oxford and IBH Publishing Co.

Caratopher D., Hill Yerstal, Publishers Charolisle Livil

Practical Hematology by Sie Icha Oalie, Publisher Claurcvill Acoudon

- Pvt. Ltd. New Delhi.
- 3. Aggarwal SK (2005) Advanced Environmental Biotechnology, APH publication

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# This course will be available for the students from other faculty GE/ OE -2/MBN 212 : Food Fermentations

Total Credits: 02

Total Contact Hours: 30 Hrs

Resket 1: List of Major subjects in Science (BSC)

Maximum Marks: 50

# Learning Objectives:

The students will gain knowledge about the various fermentation concepts, different fermented foods obtained from milk, meat, grain and vegetables etc.

# Course Outcomes (CO's)

After successful completion of this course, students are expected to:

CO1: Understanding Fermentation Principles: Students will develop a comprehensive understanding of the science and principles of fermentation, including the role of microorganisms (bacteria, yeast, and molds) in the fermentation process and the biochemical changes that occur during fermentation.

CO2: Fermentation Techniques and Practices: Students will learn various fermentation techniques used for different food sources, including vegetables, grains, meat, and milk.

CO3: Product Development and Quality Control: They will understand how to monitor and control the quality and safety of these products throughout the fermentation process.

CO4: Cultural and Nutritional Significance: Students will gain insights into the cultural and nutritional significance of fermented foods.

Module No.		
I	Milk Based Fermented Foods     Definition, types, advantages and health benefits     Curd, Yog'urt, Buttermilk, Kefir and cheese: Preparation of inoculums, types of microorganisms and production process	10 Hrs
3	Meat based fermented food and Probiotic Food     Definition, types, microorganisms and health benefits	
II	Vegetable Based Fermented Foods     Definition, types, advantages and health benefits.     Vegetable: Pickles, Sauerkraut, Kimchi, Jalapenos, olives:     Microorganisms and production process	10 Hrs
III	Grain Based Fermented Foods     Definition, types, advantages and health benefits     Soy sauce, Bread, Idli, Dosa Dhokla, Hussuwa, Rye Bread:     Microorganisms and production process	10 Hrs

# Text Books:

- 1. Modern Food Microbiology: James M. Jay.
- 2. Food Microbiology: W. C. Frazier, D. C. West Hoff

# Basket 1: List of Major subjects in Science (DSC)

Students willing to pursue their bachelors in the Faculty of Science and Technology shall choose any three subjects (from the following options) as Major 1, Major 2 and Major 3 (Based on the available options in the respective college)

Semester	Sr No	BOS / Ad hoc Board proposing the course	Title of the Corse
henenret	ns, different	BOS in Botany	Botany
	2	BOS in Chemistry	Chemistry
1 <sup>st</sup> and 2 <sup>nd</sup>	2		Analytical Chemistry
Semester		of this course, students are expected to:	Polymer Chemistry
(Students shall	La 3 birlos	BOS in Mathematics	Mathematics
choose any three	4	BOS in Physics	Physics
subjects (from	4, 4	BOS III Fllysics	Non-Conventional and
these options) as		chaigher and Practices; Students will lear	Conventional Energy
Major 1, Major 2	th heart an	erest fixed evences including venetables are	Instrumentation Practice
and Major 3	5	BOS in Zoology	Zoology
( Based on the	6	BOS in Electronics	Electronics
available options	STATE OF THE PARTY		Fishery Science
in the respective	7	BOS in Fishery Science	Microbiology
college)	8	BOS in Microbiology	Statistics
Hours	9	Ad Hoc Board in Statistics	Industrial Chemistry
	10	Ad hoc Board in Industrial Chemistry	Dairy Science &
	11	Ad hoc Board in Dairy Science &	Technology
		Technology	CONTRACTOR OF THE PERSON OF TH
10 Hrs	12	Ad hoc Board in Biotechnology and	Biotechnology Bioinformatics
	220001	Bioinformatics	
	13	Ad hoc Board in Biochemistry	Biochemistry
	14	Ad hoc Board in Home Science	Home Science
	15	Ad Hoc Board in Agrochemical	Agrochemical Fertilizers
87H 01		Fertilizers, Horticulture, Dry land Agriculture	Horticulture
	16	Ad hoc Board in Forensic Science	Forensic Science
	-	cond it is remained to the condition of	Forensic Science & Cyber
MIT OF		Smeat tell thesi Their Their Parents It we Bress	Security
	17	Ad Hoc Board in Computer Science	Computer Science
			Computer Application
			Information Technology
	The Marie	72	Data Science
	18	Ad Hoc Board in Networking and Multimedia	Networking and Multimedia
	19	Ad Hoc Board in Environmental Science	Environmental Science
	20	BOS in Fishery Science	Fishery Science
	21	Ad hoc Board in Automobile Technology	Automobile Technology
	2.	/ Workshop Technology / Refrigerator	Workshop Technology
		and Air Conditioning	Refrigerator and Air

		Conditioning
22	Ad hoc Board in Geology	Geology

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