KRANTIGURU SHYAMJI KRISHNA VERMA KACHCHH UNIVERSITY, BHUJ.

Year: 2023-2024

B.Sc (Honours) MICROBIOLOGY

(With Research /Without Research)

Semesters : I and II

(Exit option)

FACULTY OF SCIENCE

SYLLABUS

Curriculum as per UGC Guideline
Framed according to National Education Policy (NEP) - 2020
With effect from June – 2023 (and thereafter)

B.Sc. (Honours) MICROBIOLOGY Programme

(With Research/without Research)

NEP-2020

With effect from June – 2023 (and thereafter)

FACULTY OF SCIENCE

Subject: MICROBIOLOGY

B. Sc. Semesters: I & II

NATURE AND EXTENT OF BACHELOR'S DEGREE PROGRAMME IN MICROBIOLOGY (HONOURS)

A bachelor's degree in Microbiology with Research or without Research is a 4 year degree course which is divided into 8 semesters.

Sl.No.	Type of Award	Stage of Exit	Mandatory Credits to be securedfor the Award
1	Certificate in the Discipline	After successful completion of 1st Year	
2	Diploma in the Discipline	After successful completion of 1st and 2nd Years	
3	B.Sc. in Microbiology	After successful completion of 1st, 2nd and 3rd Years	
4	B.Sc. (Honours with Research/without Research) in Microbiology	After successful completion of 1st, 2nd, 3rd and 4th Years	

A student pursuing 4 years undergraduate programme with research in a specific discipline shall be awarded an appropriate Degree in that discipline on completion of 8th Semester if he/she secures _____ Credits. Similarly, for certificate, diploma and degree, a student needs to fulfill the associated credits. An illustration of credits requirements in relation to the type of award is illustrated as above.

Bachelor's Degree (Honours) is a well-recognized, structured, and specialized graduate level qualification in tertiary, collegiate education. The contents of this degree are determined in terms of knowledge, understanding, qualification, skills, and values that a student intends to acquire to look for professional avenues or move to higher education at the postgraduate level.

Bachelor's Degree (Honours) programmes attract entrants from the secondary level or equivalent, often with subject knowledge that may or may not be directly relevant to the field of study/profession. Thus, B.Sc. (Honours) Course in Microbiology aims to equip students to qualify for joining a profession or to provide development opportunities in particular employment settings. Graduates are enabled to enter a variety of jobs or to continue academic study at a higher level.

AIMS:

1. To develop the curriculum for fostering discovery-learning.
2. To adopt recent pedagogical trends in education including e-learning, flipped class, hybrid learning and MOOCs
3. To mold responsible citizen for nation-building and transforming the country towards the future.
4. To provide an environment that ensures cognitive development of students in a holistic manner. A dialogue about Microorganisms and its significance is promoted in this framework, rather than didactic monologues on mere theoretical aspects.

5. To provide the latest subject matter, both theoretical as well as practical, such away to foster their core competency and discovery learning. A Microbiology graduate as envisioned in this framework would be sufficiently competent in the field to undertake further discipline-specific studies, as well as to begin domain-related employment.
6. To mould a responsible citizen who is aware of most basic domain-independent knowledge, including critical thinking and communication.
7. To enable the graduate, prepare for national as well as international competitive examinations, especially UGC-CSIR NET and UPSC Civil Services Examination.

COURSE INTRODUCTION

The new curriculum of B.Sc. in Science (MICROBIOLOGY) offers essential knowledge and technical skills to study Microorganisms and its interaction in Environment. Students would be trained in all areas of Microbiology using a unique combination of core, elective and vocational papers with significant inter-disciplinary components. Students would be exposed to cutting-edge technologies that are currently being used in the study of microorganisms, their evolution and interactions with other organisms within the ecosystem. Students would also become aware of the social and environmental significance of microorganisms and their relevance to the national economy.

B.Sc. Microbiology Programme covers academic activities within the classroom sessions along with practical concepts at laboratory sessions. Infield, outstation activities and projects would also be organized for real-life experience and learning. Candidates who have curiosity in Microorganisms, ecosystem, love exploring exotic places and wish to work as researchers or professions like Botanist, Conservationist, Ecologist, etc. can choose B.Sc. Microbiology course.

Programme outcomes (POs):

Transformed curriculum shall develop educated outcome-oriented candidature, to develop into responsible citizen for nation-building and transforming the country towards the future with their knowledge gained in the field of Microbiology.

Programme specific objectives (PSOs): B.Sc. I Year Certificate Course in Introduction To Microbial World

- ✓ This certificate course will provide knowledge on various fields of Microbiology.
- ✓ The syllabus is prepared to enable students for competitive exams in frontier areas of Microbiology.
- ✓ Students will be able to know about various microorganisms.
- ✓ Student shall produce competent Microbiologist who can employ and implement their gained knowledge in basic and applied aspects that will profoundly influence the prevailing paradigm of agriculture, industry, healthcare and environment to provide sustainable development.
- ✓ Certificate and diploma courses are framed to generate self- entrepreneurship and self-employability, if multi exit option is opted.

- ✓ Lifelong learning is achieved by drawing attention to the vast world of knowledge of microorganisms and their domestication.
- ✓ Students will increase the ability of critical thinking, development of scientific attitude, handling of problems and generating solutions, improve practical skills, enhance communication skill, social interaction, and increase awareness in use of microorganism's in various Fields.
- ✓ The training provided to the students will make them competent enough for doing jobs in Govt. and private sectors of academia, research and industry along with graduate preparation for national as well as international competitive examinations, especially UGC-CSIR NET, UPSC Civil Services Examination, IFS, NSC, FCI, BSI, FRI etc., as well self-employment.

TEACHING LEARNING PROCESS

Teaching and learning in this programme involve classroom lectures as well tutorials.

It allows-

- The tutorials allow a closer interaction between the students and the teacher aseach student gets individual attention.
- Written assignments and projects submitted by students
- Project-based learning
- Group discussion
- Home assignments
- Quizzes and class tests
- PPT presentations, Seminars, interactive sessions
- Diversity survey
- Co-curricular activity etc.
- Study Tour or Field visit

EVALUATION METHODS:

Academic performance in various courses *i.e.* **DSC, IDC/MDC, AEC. VAC** and **SEC** are to be considered as parameters for assessing the achievement of students in the Microbiology subject. A number of appropriate assessment methods of microbiology will be used to determine the extent to which students demonstrate desired learning outcomes.

1. A student shall be evaluated through Comprehensive Continuous Assessment (**CCA**)/ (***Internal Evaluation***) as well as the **End of Semester examination** (***External Evaluation***). The weight-age of CCA shall be 50%, whereas the weight-age of the Semester end examination shall be 50%.CCA will include test/online-offline exam/ seminars/assignments/ submissions/ student attendance and active participations.

2. The **End of Semester examination** (***External Evaluation***) shall have anassessment based upon following perspective with respect to all the courses:

   a. Evaluation with respect to Knowledge,

b. Evaluation with respect to Understanding,

c. Evaluation with respect to Skill,

d. Evaluation with respect to Application and

e. Higher Order Thinking Skills.

- The End of Semester Examination will be conducted by the University. A certified journal of the respective practical course must be produced at the time of practical examination by the student.
- This is compulsory to record laboratory work in the Journal. Certified journal has to produce while appearing at the time of Practical examination

Year	Semester	Course Code	Paper Title	Credits	Marks		Total
					CA	UA	
First Year	I	MAJ MB 101 (Theory)	**Introduction To Microbial World**	3	35	40	75
	I	MAJ MB 102-P (Practical)	As above (lab course)	1	15	10	25
	I	MAJ MB 103 (Theory)	**Fundamentals Of Microscopy**	3	35	40	75
	I	MAJ MB 104-P (Practical)	As above (lab course)	1	15	10	25
			Total Credits	8	**Total Marks**		200
	I	MIN MB 105 (Theory)	**Introduction To Microbial World**	3	35	40	75
	I	MIN MB 106-P (Practical)	As above (lab course)	1	15	10	25
			Total Credits	4	**Total Marks**		100
	I	MDC MB 107 (Theory)	**Introduction To Microbial World**	3	35	40	75
	I	MDC MB 108-P (Practical)	As above (lab course)	1	15	10	25
			Total Credits	**4**	**Total Marks**		**100**
	II	MAJ MB 201 (Theory)	**Basic Bacteriology**	3	35	40	75
	II	MAJ MB 202-P (Practical)	As above (lab course)	1	15	10	25
	II	MAJ MB 203 (Theory)	**Nutrition And Growth of Bacteria**	3	35	40	75
	II	MAJ MB 204-P (Practical)	As above (lab course)	1	15	10	25
			Total Credits	8	**Total Marks**		**200**
	II	MIN MB 205 (Theory)	**Basic Bacteriology**	3	35	40	75
	II	MIN MB 206-P (Practical)	As above (lab course)	1	15	10	25
			Total Credits	4	**Total Marks**		**100**
	II	MDC MB 207 (Theory)	**Basic Bacteriology**	3	35	40	75
	II	MDC MB 208-P (Practical)	As above (lab course)	1	15	10	25
			Total Credits	**4**	**Total Marks**		**100**

The Structure of the Question Paper for the University Theory Exam
MAJ/MIN/MDC MB-101/103/105/107/201/203/205/207

Total Marks : 40
Total No. of Questions : 04

Questions	Section	Marks
Question – 1 Unit – I	**(Descriptive - Essay type – Short notes *with internal option) 2 out of 3***	**10 marks**
Question – 2 Unit –II	**–do-**	**10 marks**
Question – 3 Unit – III	**–do-**	**10 marks**
Question – 4 (Unit I to III)	**(10 out of 12) 1 Marks Each**	**10 Marks**

- The examination pattern of the university is around 50% external and 50% internal.
- Types of questions for Question 4 may be varied like: definitions / reasoning / drawing small figures/ label the figure / fill in the blanks / multiple choice questions/ one word answer / match the pairs etc.
- Project work/ Visit/ Tour/ Charts/ Model/ Given by teacher or as a part of Syllabus) will be mandatory for all the students.

DETAILED SYLLABUS OF B.Sc. I YEAR FOR CERTIFICATE COURSE IN MICROBIOLOGY

KSKV Kachchh University, Bhuj - Kachchh

(Effective from June 2023-24 UNDER NEP-2020)

SEMESTER 1:

COURSE TITLE: INTRODUCTION TO MICROBIAL WORLD

(Course code: MAJ MB 101) Credit: 3

DISCIPLINE SPECIFIC CORE COURSES (MAJOR)							
COURSE	*SEMESTER*	*COURSE CODE*	*COURSE TITLE*	*THEORY*			
				Credits	*Lectures*	*External*	*Internal*
Certificate Course	*B.Sc. I*	*MAJ MB-101*	INTRODUCTION TO MICROBIAL WORLD	3	45	*40 Marks*	*35 Marks*

Course Outcomes (COs):

Upon success full completion of these paper students will learn about Basic Microbiology concept like Students will learn about the discovery of microbial world Students will know about the role of microorganisms in disease development, Development of pure culture techniques, chemotherapy, agricultural microbiology, immunology and biotechnology, the multifaceted existence of microorganisms, the major groups of microorganisms and its distribution.

UNIT-I	**DEVELOPMENT OF MICROBIOLOGY AS A NEW DISCIPLINE OF BIOLOGICAL SCIENCE:**	**15 Hours**
	HISTORY OF MICROBIOLOGY:	
	The discovery of Microbial World and Microscope The spontaneous generation controversy Discovery of microbial effects on organic matter Establishment of germ theory of diseases and fermentation. History of Virology	
UNIT-II	**DEVLOPMENT OF MICRBIOLOGY**	**15 Hours**
	Development of pure culture techniques Development of Foundation for immunology Work of Winogradsky and Beijerinck Development of Chemotherapy Development of Modern immunology Molecular Biology and Biotechnology	

UNIT-III	**SCOPE OF MICROBIOLOGY**	**15 Hours**
	An introduction to Microbiology Microbiology: A multifaceted Science Diversity in microbial habitat and Distribution of microorganisms in nature. Types of microorganisms: Introduction to prokaryotic world, eukaryotic microorganisms, viruses and other microorganisms. Impact of microorganisms in environment and its impact on human life. Thrust areas of Microbiology: Genetic engineering and Biotechnology	

REFERENCE BOOKS:

1. Microbiology, Pelczar, M.J.chan, E.C.S., Krig, N.R., McGrow – Hill Book Co.
2. Microbiology by J.G. Black, 2002
3. Introduction to Microbiology by J.L.Ingraham and C.A.Ingraham, 2000.
4. Text book of Environmental studies for Undergraduate courses. Erach Bharucha. UGC, Universities Press, Orient Longman Pvt.Ltd.
5. Microbial Ecology, R Campbell. Johan Wiley and Sons.
6. Modi. H. A. (2014) A Handbook of Elementary Microbiology, Shanti Prakashan, (ISBN: 978-93- 5070-1010)
7. Pommerville J.C. (2014) Alcamo's Fundamental of Microbiology, 10th Edition, Jones &BarlettPvt. Ltd., (ISBN: 978-0-07-462320-6)
9. Medigan M., et al., (2015) Brock Biology of Microorganisms, 14th Edition, Pearson education Ltd., (ISBN: 978-1-292-01831-7)
10. Introduction to Microbial World :Ritesh Tandel, Komal Chawda & Kalpesh Sorthia.

KSKV Kachchh University, Bhuj - Kachchh

(Effective from June 2023-24 UNDER NEP-2020)

SEMESTER 1:

Course Title: INTRODUCTION TO MICROBIAL WORLD

Practical/ Lab course (Course code: MAJ MB 102-P) Credit: 2

DISCIPLINE SPECIFIC CORE COURSE (MAJOR)						
COURSE	***SEMESTER***	***COURSE CODE***	***COURSE TITLE***	***PRACTICAL***		
				Credits	***PRACTICAL***	***INTERNAL/External***
Certificate Course	**B.Sc. I**	***MAJ MB-102-P***	**INTRODUCTION TO MICROBIAL WORLD**	**1**	**30**	***25(15+10) Marks***
	***TOPIC* (30hr)**					

1. Study of principles and working of laboratory instruments: Light microscope, Autoclave, Hot air oven, Incubator, Bacteriological filter, Rotary shaker, pH meter, Spectrophotometer, Centrifuge.
2. Cleaning and preparation of glass ware for sterilization
3. Disposal of laboratory waste and cultures
4. Study of hay infusion
5. Study of bacterial motility
6. Measurement of size of bacteria and yeast by use of micrometer
7. Study of permanent slides of different groups of microorganisms
   A. Prokaryotes – bacteria Cocci, Short rods, Bacilli, Spirochetes, Curved bacteria, Filamentous bacteria – Actinomycetes, Rickettsiae
   B. Eukaryotic organisms
   a. Fungi: Yeast, Mucor, Rhizopus, Aspergillus, Penicillium,
   b. Algae: Diatoms, Spirogyra
   c. Protozoa: Amoeba, Paramecium, Plasmodium

References:

1. Patel R.J. and Patel R.K. (2016) Experimental microbiology Volume I, 9thEdition.Aditya
2. Patel R.J. and Patel R.K. (2017) Experimental microbiology Volume II, 9th Edition. Aditya
3. Cappuccino J.G. (2016) Microbiology; A Laboratory Manual, 11th Edition. Pearson Edication (Singapore) Pvt. Ltd., (ISBN: 978-9332535190)
4. Aneja K.R. (2001) Experiments in Microbiology, Plant Pathology, Tissue culture and Mushroom production technology, 3 rd Edition. New Age International Publishers, (ISBN: 978-9386418302)

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SEMESTER 1:

COURSE TITLE: INTRODUCTION TO MICROBIAL WORLD

B. Sc.: MICROBIOLOGY INTERNAL PRACTICAL ***MAJ MB-102P***

Date: ***Place:*** ***Time: ___Hrs*** ***Total Marks: 15***

Ex 1. Write principles and working of laboratory instruments 05 Marks (or)

Ex 1. a. Study of hay infusion 05 Marks

b. Study of bacterial motility

c. Measurement of size of bacteria and yeast by use of micrometer (or)

Ex.1. Study of presence of microorganisms in different habitat – environment Air, Water, Soil, Food, Milk, Curd, Skin, Surface of table, 05 Marks

Ex 2 Spotting 05Marks

Ex 3 Viva voce 02 Marks

Ex 4 Journal 03 Marks

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SEMESTER 1:

COURSE TITLE: INTRODUCTION TO MICROBIAL WORLD

B. Sc. : MICROBIOLOGY UNIVERSITY PRACTICAL ***MAJ MB-102-P***

Date: ***Place:*** ***Time: ___Hrs*** ***Total Marks: 10***

Ex 1. Write Principles and working of laboratory instruments 1.5 Marks

Ex 2. a. Study of hay infusion 05 Marks

b. Study of bacterial motility

c. Measurement of size of bacteria and yeast by use of micrometer (or)

Ex.2. Study of presence of microorganisms in different habitat – environment Air, Water, Soil, Food, Milk, Curd, Skin, Surface of table, 05 Marks

Ex 3 Spotting 1.5Marks

Ex 4 Viva voce 01 Marks

Ex 5 Journal 01 Marks

DETAILED SYLLABUS OF B.Sc. I YEAR FOR CERTIFICATE COURSE IN MICROBIOLOGY

KSKV Kachchh University, Bhuj - Kachchh

(Effective from June 2023-24 UNDER NEP-2020)

SEMESTER 1:

COURSE TITLE: FUNDAMENTALS OF MICROSCOPY

(Course code: MAJ MB 103) Credit: 3

DISCIPLINE SPECIFIC CORE COURSES (MAJOR)							
COURSE	***SEMESTER***	***COURSE CODE***	***COURSE TITLE***	***THEORY***			
				Credits	***Lectures***	***External***	***Internal***
Certificate Course	***B.Sc. I***	***MAJ MB-103***	**FUNDAMENTALS OF MICROSCOPY**	**3**	**45**	***40 Marks***	***35 Marks***

Course Outcomes (COs):

Upon success full completion of these paper students will learn about Fundamentals of microscopy concept like Students will learn to understand the fundamentals of microscopy To learn different types of light microscopy and its uses To study electron microscopy, its types and advances in electron microscopy. To learn basics of dyes and stains and the principle of staining microorganisms.

UNIT-I	**BASIC PRINCIPLE OF MICROSCOPY**	**15 Hours**
	General Principles of optics Structure of light Objectives – Numerical Aperture, Resolving power Immersion objectives - Depth of focus, Equivalent focus, Working distance of uncovered objects & covered objects, Chromatic aberrations in objectives. Oculars – Huygens, Compensating, Flat-field. Condenser Bright field microscope Dark field microscope	
UNIT-II	**TYPES OF MICROSCOPY**	**15 Hours**
	LIGHT MICROSCOPY:	

	Phase contrast microscope Differential Interference Contrast Microscope Fluorescence microscope Confocal microscopy	
	ELECTRON MICROSCOPY:	
	Transmission Electron microscope Scanning Electron microscope Electron cryotomography Scanning probe microscopy Scanning tunneling microscope Atomic force microscope	
UNIT-III	**Techniques used to study microorganisms**	**15 Hours**
	Definition: Pure culture and axenic culture Principles and methods of obtaining pure culture Preservation of pure culture, culture collection centers Dyes and stains: Definition, acidic basic dyes and leuco-compounds. Smear: Fixation use of mordent, intensifiers and decolorizer. Mechanism of staining. Types of staining: simple and differential staining Application of stains and dyes in study of microbiology	

REFERENCE BOOKS:

1. Microbiology, Pelczar, M.J.chan, E.C.S., Krig, N.R., McGrow – Hill Book Co.
2. Microbiology by J.G. Black, 2002
3. Introduction to Microbiology by J.L.Ingraham and C.A.Ingraham, 2000.
4. Text book of Environmental studies for Undergraduate courses. Erach Bharucha. UGC, Universities Press, Orient Longman Pvt.Ltd.
5. Microbial Ecology, R Campbell. Johan Wiley and Sons.
6. Modi. H. A. (2014) A Handbook of Elementary Microbiology, Shanti Prakashan, (ISBN: 978-93- 5070-1010)
7. Pommerville J.C. (2014) Alcamo's Fundamental of Microbiology, 10th Edition, Jones &BarlettPvt. Ltd., (ISBN: 978-0-07-462320-6)
9. Medigan M., et al., (2015) Brock Biology of Microorganisms, 14th Edition, Pearson education Ltd., (ISBN: 978-1-292-01831-7)
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(Effective from June 2023-24 UNDER NEP-2020)

SEMESTER 1:

COURSE TITLE: FUNDAMENTALS OF MICROSCOPY

Practical/ Lab course (Course code: MAJ MB 104-P) Credit: 2

DISCIPLINE SPECIFIC CORE COURSE (MAJOR)						
COURSE	***SEMESTER***	***COURSE CODE***	***COURSE TITLE***	***PRACTICAL***		
				Credits	***Lectures***	***Internal/External***
Certificate Course	**B.Sc. I**	***MAJ MB-104-P***	***FUNDAMENTALS OF MICROSCOPY***	**1**	**30**	***25(15+10) Marks***
	***TOPIC* (30hr)**					

1. Staining of bacteria
   a. Simple staining i. Positive staining ii. Negative staining
   b. Differential staining: Gram staining, Acid Fast staining
2. Preparation of nutrient media: Nutrient agar and Nutrient broth
3. pH adjustment of media by use of pH strip and pH meter
4. Isolation of bacteria by streak plate method

References:

1. Patel R.J. and Patel R.K. (2016) Experimental microbiology Volume I, 9thEdition.Aditya
2. Patel R.J. and Patel R.K. (2017) Experimental microbiology Volume II, 9th Edition. Aditya
3. Cappuccino J.G. (2016) Microbiology; A Laboratory Manual, 11th Edition. Pearson Edication (Singapore) Pvt. Ltd., (ISBN: 978-9332535190)
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SEMESTER 1:

COURSE TITLE: FUNDAMENTALS OF MICROSCOPY

B. Sc.: MICROBIOLOGY INTERNAL PRACTICAL ***MAJ MB-104P***

Date: ***Place:*** ***Time: ___Hrs*** ***Total Marks: 15***

Ex.1 Staining of bacteria 05 Marks

a. Simple staining i. Positive staining ii. Negative staining

b. Differential staining: Gram staining. Acid Fast staining (or)

Ex.1. Isolation of bacteria by streak plate method 05 Marks

Ex 2 Viva voce 02 Marks

Ex 3 Journal 03 Marks

Ex 4 Spotting 05 Marks

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(Effective from June 2023-24 UNDER NEP-2020)

SEMESTER 1:

COURSE TITLE: FUNDAMENTALS OF MICROSCOPY

B. Sc.: MICROBIOLOGY UNIVERSITY PRACTICAL ***MAJ MB-102-P***

Date: ***Place:*** ***Time: ___Hrs*** ***Total Marks: 10***

Ex.1 Staining of bacteria 05 Marks

a. Simple staining i. Positive staining ii. Negative staining

b. Differential staining: Gram staining. Acid Fast staining (or)

Ex.1. Isolation of bacteria by streak plate method 05 Marks

Ex. 2 Spotting 1.5 Marks

Ex. 3 Viva voce 02 Marks

Ex. 4 Journal 1.5 Marks

DETAILED SYLLABUS OF B.Sc. I YEAR FOR CERTIFICATE COURSE IN MICROBIOLOGY

KSKV Kachchh University, Bhuj - Kachchh

(Effective from June 2023-24 UNDER NEP-2020)

SEMESTER 1:

COURSE TITLE: INTRODUCTION TO MICROBIAL WORLD

(Course code: MIN MB 105) Credit: 3

DISCIPLINE SPECIFIC CORE COURSES (MINOR)							
COURSE	***SEMESTER***	***COURSE CODE***	***COURSE TITLE***	***THEORY***			
				Credits	***Lectures***	***External***	***Internal***
Certificate Course	***B.Sc. I***	***MIN MB-105***	**Introduction To Microbial World**	**3**	**45**	***40 Marks***	***35 Marks***

Course Outcomes (COs):

Upon success full completion of these paper students will learn about Basic Microbiology concept like Students will learn about the discovery of microbial world Students will know about the role of microorganisms in disease development, Development of pure culture techniques, chemotherapy, agricultural microbiology, immunology and biotechnology, the multifaceted existence of microorganisms, the major groups of microorganisms and its distribution.

UNIT-I	**Development of microbiology as a new discipline of biological science:**	**15 Hours**
	HISTORY OF MICROBIOLOGY:	
	The discovery of Microbial World and Microscope The spontaneous generation controversy Discovery of microbial effects on organic matter Establishment of germ theory of diseases and fermentation. History of Virology	
UNIT-II	**DEVLOPMENT OF MICRBIOLOGY**	**15 Hours**
	Development of pure culture techniques Development of Foundation for immunology Work of Winogradsky and Beijerinck Development of Chemotherapy Development of Modern immunology Molecular Biology and Biotechnology	

UNIT-III	**SCOPE OF MICROBIOLOGY**	**15 Hours**
	An introduction to Microbiology Microbiology: A multifaceted Science Diversity in microbial habitat and Distribution of microorganisms in nature. Types of microorganisms: Introduction to prokaryotic world, eukaryotic microorganisms, viruses and other microorganisms. Impact of microorganisms in environment and its impact on human life. Thrust areas of Microbiology: Genetic engineering and Biotechnology	

REFERENCE BOOKS:

1. Microbiology, Pelczar, M.J.chan, E.C.S., Krig, N.R., McGrow – Hill Book Co.
2. Microbiology by J.G. Black, 2002
3. Introduction to Microbiology by J.L.Ingraham and C.A.Ingraham, 2000.
4. Text book of Environmental studies for Undergraduate courses. Erach Bharucha. UGC, Universities Press, Orient Longman Pvt.Ltd.
5. Microbial Ecology, R Campbell. Johan Wiley and Sons.
6. Modi. H. A. (2014) A Handbook of Elementary Microbiology, Shanti Prakashan, (ISBN: 978-93- 5070-1010)
7. Pommerville J.C. (2014) Alcamo's Fundamental of Microbiology, 10th Edition, Jones &BarlettPvt. Ltd., (ISBN: 978-0-07-462320-6)
9. Medigan M., et al., (2015) Brock Biology of Microorganisms, 14th Edition, Pearson education Ltd., (ISBN: 978-1-292-01831-7)
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(Effective from June 2023-24 UNDER NEP-2020)

SEMESTER 1:

COURSE TITLE: INTRODUCTION TO MICROBIAL WORLD

Practical/ Lab course (Course code: MIN MB 106-P) Credit: 2

DISCIPLINE SPECIFIC CORE COURSE (MINOR)						
COURSE	***SEMESTER***	***COURSE CODE***	***COURSE TITLE***	***PRACTICAL***		
				Credits	***PRACTICAL***	***INTERNAL/External***
Certificate Course	**B.Sc. I**	***MIN MB-106-P***	**INTRODUCTION TO MICROBIAL WORLD**	**1**	**30**	***25(15+10) Marks***
	***TOPIC* (30hr)**					

1. Study of principles and working of laboratory instruments: Light microscope, Autoclave, Hot air oven, Incubator, Bacteriological filter, Rotary shaker, pH meter, Spectrophotometer, Centrifuge.
2. Cleaning and preparation of glass ware for sterilization
3. Disposal of laboratory waste and cultures
4. Study of hay infusion
5. Study of bacterial motility
6. Measurement of size of bacteria and yeast by use of micrometer
7. Study of permanent slides of different groups of microorganisms
   A. Prokaryotes – bacteria Cocci, Short rods, Bacilli, Spirochetes, Curved bacteria, Filamentous bacteria – Actinomycetes, Rickettsiae
   B. Eukaryotic organisms
   a. Fungi: Yeast, Mucor, Rhizopus, Aspergillus, Penicillium,
   b. Algae: Diatoms, Spirogyra
   c. Protozoa: Amoeba, Paramecium, Plasmodium

References :

1. Patel R.J. and Patel R.K. (2016) Experimental microbiology Volume I, 9thEdition.Aditya
2. Patel R.J. and Patel R.K. (2017) Experimental microbiology Volume II, 9th Edition. Aditya
3. Cappuccino J.G. (2016) Microbiology; A Laboratory Manual, 11th Edition. Pearson Edication (Singapore) Pvt. Ltd., (ISBN: 978-9332535190)
4. Aneja K.R. (2001) Experiments in Microbiology, Plant Pathology, Tissue culture and Mushroom production technology, 3 rd Edition. New Age International Publishers, (ISBN: 978-9386418302)

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SEMESTER 1:

Course Title: INTRODUCTION TO MICROBIAL WORLD

B. Sc.: MICROBIOLOGY INTERNAL PRACTICAL **MIN *MB-106*P**

Date: ***Place:*** ***Time: ___Hrs*** ***Total Marks: 15***

Ex 1. Write principles and working of laboratory instruments 05 Marks (or)

Ex 1. a. Study of hay infusion 05 Marks

d. Study of bacterial motility

e. Measurement of size of bacteria and yeast by use of micrometer (or)

Ex.1. a. Study of presence of microorganisms in different habitat – environment Air, Water, Soil, Food, Milk, Curd, Skin, Surface of table, 05 Marks

Ex 2 Spotting 05Marks

Ex 3 Viva voce 02 Marks

Ex 4 Journal 03 Marks

KSKV Kachchh University, Bhuj - Kachchh

(Effective from June 2023-24 UNDER NEP-2020)

SEMESTER 1:

Course Title: INTRODUCTION TO MICROBIAL WORLD

B. Sc.: MICROBIOLOGY UNIVERSITY PRACTICAL ***MIN MB-106-P***

Date: ***Place:*** ***Time: ___Hrs*** ***Total Marks: 10***

Ex 1. Write principles and working of laboratory instruments 1.5 Marks

Ex 2. a. Study of hay infusion 05 Marks

b. Study of bacterial motility

c. Measurement of size of bacteria and yeast by use of micrometer (or)

Ex.2. Study of presence of microorganisms in different habitat – environment Air, Water, Soil, Food, Milk, Curd, Skin, Surface of table, 05 Marks

Ex 3 Spotting 1.5Marks

Ex 4 Journal & Viva voce 02 Marks

DETAILED SYLLABUS OF B.Sc. I YEAR FOR CERTIFICATE COURSE IN MICROBIOLOGY

KSKV Kachchh University, Bhuj - Kachchh

(Effective from June 2023-24 UNDER NEP-2020)

SEMESTER 1:

COURSE TITLE: INTRODUCTION TO MICROBIAL WORLD

(Course code: MDC MB 107) Credit: 3

DISCIPLINE SPECIFIC CORE COURSES (MULTIDISCIPLINARY)							
COURSE	*SEMESTER*	*COURSE CODE*	*COURSE TITLE*	*THEORY*			
				Credits	*Lectures*	*External*	*Internal*
Certificate Course	*B.Sc. I*	*MDC MB-107*	**Introduction To Microbial World**	**3**	**45**	***40 Marks***	***35 Marks***

Course Outcomes (COs):

Upon success full completion of these paper students will learn about Basic Microbiology concept like Students will learn about the discovery of microbial world Students will know about the role of microorganisms in disease development, Development of pure culture techniques, chemotherapy, agricultural microbiology, immunology and biotechnology, the multifaceted existence of microorganisms, the major groups of microorganisms and its distribution.

UNIT-I	**Development of microbiology as a new discipline of biological science:**	**15 Hours**
	HISTORY OF MICROBIOLOGY:	
	The discovery of Microbial World and Microscope The spontaneous generation controversy Discovery of microbial effects on organic matter Establishment of germ theory of diseases and fermentation. History of Virology	
UNIT-II	**DEVLOPMENT OF MICRBIOLOGY**	**15 Hours**
	Development of pure culture techniques Development of Foundation for immunology Work of Winogradsky and Beijerinck Development of Chemotherapy Development of Modern immunology Molecular Biology and Biotechnology	

UNIT-III	**SCOPE OF MICROBIOLOGY**	**15 Hours**
	An introduction to Microbiology Microbiology: A multifaceted Science Diversity in microbial habitat and Distribution of microorganisms in nature. Types of microorganisms: Introduction to prokaryotic world, eukaryotic microorganisms, viruses and other microorganisms. Impact of microorganisms in environment and its impact on human life. Thrust areas of Microbiology: Genetic engineering and Biotechnology	

REFERENCE BOOKS:

1. Microbiology, Pelczar, M.J.chan, E.C.S., Krig, N.R., McGrow – Hill Book Co.
2. Microbiology by J.G. Black, 2002
3. Introduction to Microbiology by J.L.Ingraham and C.A.Ingraham, 2000.
4. Text book of Environmental studies for Undergraduate courses. Erach Bharucha. UGC, Universities Press, Orient Longman Pvt.Ltd.
5. Microbial Ecology, R Campbell. Johan Wiley and Sons.
6. Modi. H. A. (2014) A Handbook of Elementary Microbiology, Shanti Prakashan, (ISBN: 978-93- 5070-1010)
7. Pommerville J.C. (2014) Alcamo's Fundamental of Microbiology, 10th Edition, Jones &BarlettPvt. Ltd., (ISBN: 978-0-07-462320-6)
9. Medigan M., et al., (2015) Brock Biology of Microorganisms, 14th Edition, Pearson education Ltd., (ISBN: 978-1-292-01831-7)
10. Introduction to Microbial World :Ritesh Tandel, Komal Chawda & Kalpesh Sorthia.

KSKV Kachchh University, Bhuj - Kachchh

(Effective from June 2023-24 UNDER NEP-2020)

SEMESTER 1:

COURSE TITLE: INTRODUCTION TO MICROBIAL WORLD

Practical/ Lab course (Course code: MDC MB 108-P) Credit: 2

DISCIPLINE SPECIFIC CORE COURSE (MULTIDISCIPLINARY)						
COURSE	***SEMESTER***	***COURSE CODE***	***COURSE TITLE***	***PRACTICAL***		
				Credits	***PRACTICAL***	***INTERNAL/External***
Certificate Course	**B.Sc. I**	***MDC MB-108-P***	**INTRODUCTION TO MICROBIAL WORLD**	**1**	**30**	***25(15+10) Marks***
	***TOPIC* (30hr)**					

1. Study of principles and working of laboratory instruments: Light microscope, Autoclave, Hot air oven, Incubator, Bacteriological filter, Rotary shaker, pH meter, Spectrophotometer, Centrifuge.
2. Cleaning and preparation of glass ware for sterilization
3. Disposal of laboratory waste and cultures
4. Study of hay infusion
5. Study of bacterial motility
6. Measurement of size of bacteria and yeast by use of micrometer
7. Study of permanent slides of different groups of microorganisms

   A. Prokaryotes – bacteria Cocci, Short rods, Bacilli, Spirochetes, Curved bacteria, Filamentous bacteria – Actinomycetes, Rickettsiae

   B. Eukaryotic organisms

   a. Fungi: Yeast, Mucor, Rhizopus, Aspergillus, Penicillium,

   b. Algae: Diatoms, Spirogyra

   c. Protozoa: Amoeba, Paramecium, Plasmodium

References:

1. Patel R.J. and Patel R.K. (2016) Experimental microbiology Volume I, 9thEdition.Aditya
2. Patel R.J. and Patel R.K. (2017) Experimental microbiology Volume II, 9th Edition. Aditya
3. Cappuccino J.G. (2016) Microbiology; A Laboratory Manual, 11th Edition. Pearson Edication (Singapore) Pvt. Ltd., (ISBN: 978-9332535190)
4. Aneja K.R. (2001) Experiments in Microbiology, Plant Pathology, Tissue culture and Mushroom production technology, 3 rd Edition. New Age International Publishers, (ISBN: 978-9386418302)

KSKV Kachchh University, Bhuj - Kachchh

(Effective from June 2023-24 UNDER NEP-2020)

SEMESTER 1:

COURSE TITLE: INTRODUCTION TO MICROBIAL WORLD

B. Sc. : MICROBIOLOGY INTERNAL PRACTICAL **MDC *MB-108*P**

Date: ***Place:*** ***Time: ___Hrs*** ***Total Marks: 15***

Ex 1. Write principles and working of laboratory instruments 05 Marks (or)

Ex 1. a. Study of hay infusion 05 Marks

d. Study of bacterial motility

e. Measurement of size of bacteria and yeast by use of micrometer (or)

Ex.1. a. Study of presence of microorganisms in different habitat – environment Air, Water, Soil, Food, Milk, Curd, Skin, Surface of table, 05 Marks

Ex 2 Spotting 05Marks

Ex 3 Viva voce 02 Marks

Ex 4 Journal 03 Marks

KSKV Kachchh University, Bhuj - Kachchh

(Effective from June 2023-24 UNDER NEP-2020)

SEMESTER 1:

COURSE TITLE: INTRODUCTION TO MICROBIAL WORLD

B. Sc.: MICROBIOLOGY UNIVERSITY PRACTICAL ***MDC MB-108-P***

Date: ***Place:*** ***Time: ___Hrs*** ***Total Marks: 10***

Ex 1. Write principles and working of laboratory instruments 1.5 Marks

Ex 2. a. Study of hay infusion 05 Marks

b. Study of bacterial motility

c. Measurement of size of bacteria and yeast by use of micrometer (or)

Ex.2. Study of presence of microorganisms in different habitat – environment Air, Water, Soil, Food, Milk, Curd, Skin, Surface of table, 05 Marks

Ex 3 Spotting 1.5Marks

Ex 4 Journal & Viva voce 02 Marks

DETAILED SYLLABUS OF B.Sc. I YEAR FOR CERTIFICATE COURSE IN MICROBIOLOGY

KSKV Kachchh University, Bhuj - Kachchh

(Effective from June 2023-24 UNDER NEP-2020)

SEMESTER II:

COURSE TITLE: BASIC BACTERIOLOGY

(Course code: MAJ MB-201) Credit: 3

DISCIPLINE SPECIFIC CORE COURSE (MAJOR)							
COURSE	***SEMESTER***	***COURSE CODE***	***COURSE TITLE***	***THEORY***			
				Credits	***Lectures***	***External***	***Internal***
Certificate Course	***B.Sc. II***	***MAJ MB-201***	**BASIC BACTERIOLOGY**	**3**	**45**	***40 Marks***	***35 Marks***
UNIT	***TOPIC*** **(45hrs)**						

Course Outcomes (COs):

The main aspects of this paper are to describe the bacterial taxonomy and nomenclature, basic structure of typical prokaryotes and archaea. It focuses on important differences in structure between bacteria and archaea. Understand diversified nutritional requirements of microorganisms and their cultivation using various different media. It also focuses on bacterial and archaeal reproduction, cell cycle, growth curve and effect of various environmental factors on growth of microorganisms.

UNIT-I	**INTRODUCTION TO BACTERIAL TAXONOMY AND NOMENCLATURE**	**15 Hours**
	a. Principles of binomial system of nomenclature b. Introduction to different systems of bacterial classification, Haeckel's three kingdom concept, Whittaker's five kingdom concept, Six kingdom classification, Eight kingdom classification and Carl Woese system of classification c. Introduction to Bergey.s Manual of systematic bacteriology	
UNIT-II	**TYPICAL PROKARYOTIC ORGANIZATION**	**15 Hours**
	a. Shape, size and arrangement of bacteria. b. Structure of bacterial cell c. Surface appendages of bacteria: i. General nature, arrangement, structure and role of flagella, General nature and significance of pili, prosthecae and stalks ii. Surface layers of bacteria: General nature and significance of capsule and slime layer, bacterial cell wall, Cell membrane and Mesosomes iii. Bacterial cytoplasm and cell	

	organelles: Cytoplasm, cytoplasmic inclusions, nuclear material d. Bacterial endospore: Spore structure, sporulation and spore germination	
UNIT-III	**Microbes in Extreme Environment**	**15 Hours**
	Nature, special features of the thermophilic, methanogenic and halophilic Archaea; photosynthetic bacteria, Cyanobacteria some Archaea who live in extreme conditions like cold, and space.	

REFERENCE BOOKS:

1. Microbiology, Pelczar, M.J.chan, E.C.S., Krig, N.R., McGrow – Hill Book Co.
2. Microbiology by J.G. Black, 2002 3. Introduction to Microbiology by J.L.Ingraham and C.A.Ingraham, 2000 1.
3. Willey J.M., Sherwood L.M. and Woolverton C.J., (2017) Prescott's Microbiology, 10th Edition, McGraw - Hill Education, (ISBN: 978-981-3151- 26-0)
4. Willey J.M., Sherwood L.M. and Woolverton C.J., (2008) Prescott, Harley and Klein's Microbiology, 7th Edition, McGraw - Hill Education, (ISBN: 978- 007126727-4)
5. Medigan M., et al., (2015) Brock Biology of Microorganisms, 14th Edition, Pearson education Ltd., (ISBN: 978-1-292-01831-7)
6. Basic Bacteriology: Ritesh Tandel

KSKV Kachchh University, Bhuj - Kachchh

(Effective from June 2023-24 UNDER NEP-2020)

SEMESTER II:

COURSE TITLE: BASIC BACTERIOLOGY

Practical/Lab course (Course code: MAJ MB-202-P) Credit: 1

DISCIPLINE SPECIFIC CORE COURSE (MAJOR)						
COURSE	***SEMESTER***	***COURSE CODE***	***COURSE TITLE***	***PRACTICAL***		
				Credits	***PRACTICAL***	***Internal/External***
Certificate Course	**B.Sc. II**	***MAJ MB-202-P***	**Basic Bacteriology**	**1**	**30**	***25(15+10) Marks***
UNIT	***TOPIC* (30hr)**					

1. Study of bacterial structure by use of structural staining:
   A. Endospore staining: Snyder's modification of Dorner's method
   B. Cell wall staining: Dyer's method
   C. Capsule staining: Hiss's method OR Maneval's method
   D. Volutin granules staining: Albert's method
2. Use of special staining technique to study bacteria:
   A. Spirochete staining: Fontana's staining method
   B. Flagella staining – Leifson's method.
   C. Cytoplasmic membrane staining by victoria blue stain
   D. Nucleusstaining- Feulgen's method.

References:

1. Patel R.J. and Patel R.K. (2016) Experimental microbiology Volume I, 9thEdition.Aditya,
2. Patel R.J. and Patel R.K. (2017) Experimental microbiology Volume II, 9th Edition. Aditya,
3. Cappuccino J.G. (2016) Microbiology; A Laboratory Manual, 11th Edition. Pearson Edication (Singapore) Pvt. Ltd., (ISBN: 978-9332535190)

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(Effective from June 2023-24 UNDER NEP-2020)

SEMESTER 2 :

COURSE TITLE: BASIC BACTERIOLOGY

B. Sc.: MICROBIOLOGY INTERNAL PRACTICAL ***MAJ MB-202-P***

Date: ***Place:*** ***Time: ___Hrs*** ***Total Marks: 15***

Ex.1. Study of bacterial structure by use of structural staining: 10/Marks

A. Endospore staining: Dorner's method

B. Cell wall staining: Dyer's method

C. Capsule staining: Hiss's method

D. Volutin granules staining: Albert's method

E. Spirochete staining: Fontana's staining method

F. Spirochete staining: Fontana's staining method

G. Flagella staining – Leifson's method.

H. Cytoplasmic membrane staining by victoria blue stain

I. Nucleusstaining- Feulgen's method.

Ex. 2 Viva voce 02 Marks

Ex. 3 Journal 03 Marks

KSKV Kachchh University, Bhuj - Kachchh

(Effective from June 2023-24 UNDER NEP-2020)

SEMESTER 2 :

COURSE TITLE: BASIC BACTERIOLOGY

B. Sc.: MICROBIOLOGY UNIVERSITY PRACTICAL ***MAJ MB-202-P***

Date: ***Place:*** ***Time: ___Hrs*** ***Total Marks: 10***

Ex.1. Study of bacterial structure by use of structural staining: 05 Marks

A. Endospore staining: Dorner's method

B. Cell wall staining: Dyer's method

C. Capsule staining: Hiss's method

D. Volutin granules staining: Albert's method

E. Spirochete staining: Fontana's staining method

F. Spirochete staining: Fontana's staining method

G. Flagella staining – Leifson's method.

H. Cytoplasmic membrane staining by victoria blue stain

I. Nucleus staining- Feulgen's method.

Ex. 2 Spotting 1.5 Marks

Ex. 3 Viva voce 02 Marks

Ex. 4 Journal 1.5 Marks

DETAILED SYLLABUS OF B.Sc. I YEAR FOR CERTIFICATE COURSE IN MICROBIOLOGY

KSKV Kachchh University, Bhuj - Kachchh

(Effective from June 2023-24 UNDER NEP-2020)

SEMESTER II:

COURSE TITLE: NUTRITION AND GROWTH OF BACTERIA

(Course code: MAJMB-203) Credit: 3

DISCIPLINE SPECIFIC CORE COURSE (MAJOR)							
COURSE	***SEMESTER***	***COURSE CODE***	***COURSE TITLE***	***THEORY***			
				Credits	***Lectures***	***External***	***Internal***
Certificate Course	***B.Sc. II***	***MAJMB-203***	**NUTRITION AND GROWTH OF BACTERIA**	**3**	**45**	***40 Marks***	***35 Marks***
UNIT	***TOPIC*** **(45hrs)**						

Course Outcomes (COs):

The main aspects of this paper are to describe the bacterial taxonomy and nomenclature, basic structure of typical prokaryotes and archaea. It focuses on important differences in structure between bacteria and archaea. Understand diversified nutritional requirements of microorganisms and their cultivation using various different media. It also focuses on bacterial and archaeal reproduction, cell cycle, growth curve and effect of various environmental factors on growth of microorganisms.

UNIT-I	**INTRODUCTION TO BACTERIAL NUTRITION AND CULTURE MEDIA**	**15 Hours**
	Nutritional diversities in bacteria. Nutritional requirements of bacteria. Culture media: Principles of media formulation. Media ingredients. Types of culture media. Cultivation methods of bacteria. Enrichment and isolation of pure culture Characteristics of growth in broth and solid media,	
UNIT-II	**BACTERIAL GROWTH**	**15 Hours**
	Bacterial and Archaeal reproduction by binary fission Bacterial cell cycle Bacterial Growth curve	

	Microbial population size measurement Chemostat and turbidostat for Continuous culture	
UNIT-III	**PRINCIPLES OF MICROBIAL CONTROL**	**15 Hours**
	a. General principles: Control by killing, inhibition and removal. b. Physical agents of microbial control c. Chemical agents of microbial control: Ideal antimicrobial chemical agent. Major groups of antimicrobial chemical agent.	

REFERENCE BOOKS:

1. Microbiology, Pelczar, M.J.chan, E.C.S., Krig, N.R., McGrow – Hill Book Co.
2. Microbiology by J.G. Black, 2002 3. Introduction to Microbiology by J.L.Ingraham and C.A.Ingraham, 2000 1.
3. Willey J.M., Sherwood L.M. and Woolverton C.J., (2017) Prescott's Microbiology, 10th Edition, McGraw - Hill Education, (ISBN: 978-981-3151- 26-0)
4. Medigan M., et al., (2015) Brock Biology of Microorganisms, 14th Edition, Pearson education Ltd., (ISBN: 978-1-292-01831-7)
5. Basic Bacteriology: Ritesh Tandel

KSKV Kachchh University, Bhuj - Kachchh

(Effective from June 2023-24 UNDER NEP-2020)

SEMESTER II:

COURSE TITLE: NUTRITION AND GROWTH OF BACTERIA

Practical/Lab course (Course code: MAJ MB-204-P) Credit: 1

DISCIPLINE SPECIFIC CORE COURSE MAJOR						
COURSE	***SEMESTER***	***COURSE CODE***	***COURSE TITLE***	***PRACTICAL***		
				Credits	***Lectures***	***Internal/External***
Certificate Course	**B.Sc. II**	***MAJ MB-204-P***	***NUTRITION AND GROWTH OF BACTERIA***	**1**	**30**	***25(15+10) Marks***
	***TOPIC* (30hr)**					

1. Preparation and study of different types of culture media: Mac-Conkeys's agar medium, deoxycolate citrate agar medium, glucose yeast agar medium, thioglycolate broth medium, Robertson's cooked meat medium, potato dextrose agar medium.
2. Cultivation methods for bacteria:
   A. Broth culture.
   B. Agar slope/slant culture.
   C. Agar plate method: Streak plate, pour plate & spread plate methods.
3. Cultivation of anaerobic bacteria by use of:
   A. Robertson's cooked meat medium.
   B. Thioglycolate broth.
   C. Anaerobic jar (demonstration only).
4. Preservation of microbial cultures. A. Periodic sub culturing and storage at refrigeration temperature.
5. Study of effect of various physical and chemical agents on growth of microorganisms:

A. Study of effect of pH, temperature and osmotic pressure on microorganisms.

B. Study of effect of chemicals on microbial growth.

a). Study of effect of heavy metal ions and their oligodynamic action on bacteria.

b). Use of agar cup method to study effect of chemicals: phenol, $HgCl_2$, Crystal violet.

References:

1. Patel R.J. and Patel R.K. (2016) Experimental microbiology Volume I, 9thEdition.Aditya,
2. Patel R.J. and Patel R.K. (2017) Experimental microbiology Volume II, 9th Edition. Aditya,
3. Cappuccino J.G. (2016) Microbiology; A Laboratory Manual, 11th Edition. Pearson Edication (Singapore) Pvt. Ltd., (ISBN: 978-9332535190)

KSKV Kachchh University, Bhuj - Kachchh

(Effective from June 2023-24 UNDER NEP-2020)

SEMESTER 2 :

COURSE TITLE: NUTRITION AND GROWTH OF BACTERIA

B. Sc.: MICROBIOLOGY INTERNAL PRACTICAL ***MAJ MB-204*-P**

Date: ***Place:*** ***Time: ___Hrs*** ***Total Marks: 15***

Ex.1. Preparation and study of different types of culture media: Mac-Conkeys's agar medium, deoxycolate citrate agar medium, glucose yeast agar medium, thioglycolate broth medium, Robertson's cooked meat medium, potato dextrose agar medium. (or) 10 Marks

Ex.1. Cultivation methods for bacteria/ anaerobic bacteria: 10 Marks

A. Broth culture.

B. Agar slope/slant culture.

C. Agar plate method: Streak plate, pour plate & spread plate method

D. Thioglycolate broth. (or)

Ex.1.Study of effect of various physical and chemical agents on growth of microorganisms:

A. Study of effect of pH, temperature and osmotic pressure on microorganisms.

B. Study of effect of chemicals on microbial growth. 10 Marks

C. Study of effect of heavy metal ions and their oligodynamic action on bacteria.

D. Use of agar cup method to study effect of chemicals: phenol, HgCl2, Crystal violet.

Ex 2 Viva voce 02 Marks

Ex 3 Journal 03 Marks

KSKV Kachchh University, Bhuj - Kachchh

(Effective from June 2023-24 UNDER NEP-2020)

SEMESTER 2 :

COURSE TITLE: NUTRITION AND GROWTH OF BACTERIA

B. Sc.: MICROBIOLOGY UNIVERSITY PRACTICAL ***MAJ MB-204-P***

Date: ***Place:*** ***Time: ___Hrs*** ***Total Marks: 10***

Ex.1. Preparation and study of different types of culture media: Mac-Conkeys's agar medium, deoxycolate citrate agar medium, glucose yeast agar medium, thioglycolate broth medium, Robertson's cooked meat medium, potato dextrose agar medium. 1.5 Marks

Ex.2. Cultivation methods for bacteria/ anaerobic bacteria: 5 Marks

A. Broth culture.

B. Agar slope/slant culture.

C. Agar plate method: Streak plate, pour plate & spread plate method

D. Thioglycolate broth.

E. Study of pigmented bacteria (or)

Ex.2.Study of effect of various physical and chemical agents on growth of microorganisms: 5 Marks

A. Study of effect of pH, temperature and osmotic pressure on microorganisms.

B. Study of effect of chemicals on microbial growth. C. Study of effect of heavy metal ions and their oligodynamic action on bacteria.

D. Use of agar cup method to study effect of chemicals: phenol, HgCl2, Crystal violet.

Ex. 3 Spotting 1.5Marks

Ex. 4 Journal &Viva voce 02 Marks

DETAILED SYLLABUS OF B.Sc. I YEAR FOR CERTIFICATE COURSE IN MICROBIOLOGY

KSKV Kachchh University, Bhuj - Kachchh

(Effective from June 2023-24 UNDER NEP-2020)

SEMESTER II:

COURSE TITLE: BASIC BACTERIOLOGY

(Course code: MIN MB-205) Credit: 3

DISCIPLINE SPECIFIC CORE COURSE (MINOR)							
COURSE	***SEMESTER***	***COURSE CODE***	***COURSE TITLE***	***THEORY***			
				Credits	***Lectures***	***External***	***Internal***
Certificate Course	***B.Sc. II***	***MIN MB-205***	**BASIC BACTERIOLOGY**	**3**	**45**	***40 Marks***	***35 Marks***
UNIT	***TOPIC*** **(45hrs)**						

Course Outcomes (COs):

The main aspects of this paper are to describe the bacterial taxonomy and nomenclature, basic structure of typical prokaryotes and archaea. It focuses on important differences in structure between bacteria and archaea. Understand diversified nutritional requirements of microorganisms and their cultivation using various different media. It also focuses on bacterial and archaeal reproduction, cell cycle, growth curve and effect of various environmental factors on growth of microorganisms.

UNIT-I	**INTRODUCTION TO BACTERIAL TAXONOMY AND NOMENCLATURE**	**15 Hours**
	a. Principles of binomial system of nomenclature b. Introduction to different systems of bacterial classification, Haeckel's three kingdom concept, Whittaker's five kingdom concept, Six kingdom classification, Eight kingdom classification and Carl Woese system of classification c. Introduction to Bergey.s Manual of systematic bacteriology	
UNIT-II	**TYPICAL PROKARYOTIC ORGANIZATION**	**15 Hours**
	a. Shape, size and arrangement of bacteria. b. Structure of bacterial cell c. Surface appendages of bacteria: i. General nature, arrangement, structure and role of flagella, General nature and significance of pili, prosthecae and stalks ii. Surface layers of bacteria: General nature and significance of capsule and slime layer, bacterial cell wall, Cell membrane and Mesosomes iii. Bacterial cytoplasm and cell organelles: Cytoplasm, cytoplasmic inclusions, nuclear material	

	d. Bacterial endospore: Spore structure, sporulation and spore germination	
UNIT-III	**Microbes in Extreme Environment**	**15 Hours**
	Nature, special features of the thermophilic, methanogenic and halophilic Archaea; photosynthetic bacteria, Cyanobacteria some Archaea who live in extreme conditions like cold, and space.	

REFERENCE BOOKS:

1. Microbiology, Pelczar, M.J.chan, E.C.S., Krig, N.R., McGrow – Hill Book Co.
2. Microbiology by J.G. Black, 2002 3. Introduction to Microbiology by J.L.Ingraham and C.A.Ingraham, 2000 1.
3. Willey J.M., Sherwood L.M. and Woolverton C.J., (2017) Prescott's Microbiology, 10th Edition, McGraw - Hill Education, (ISBN: 978-981-3151- 26-0)
4. Willey J.M., Sherwood L.M. and Woolverton C.J., (2008) Prescott, Harley and Klein's Microbiology, 7th Edition, McGraw - Hill Education, (ISBN: 978- 007126727-4)
5. Medigan M., et al., (2015) Brock Biology of Microorganisms, 14th Edition, Pearson education Ltd., (ISBN: 978-1-292-01831-7)
6. Basic Bacteriology: Ritesh Tandel

KSKV Kachchh University, Bhuj - Kachchh

(Effective from June 2023-24 UNDER NEP-2020)

SEMESTER II:

COURSE TITLE: BASIC BACTERIOLOGY

Practical/Lab course (Course code: MIN MB-206-P) Credit: 1

DISCIPLINE SPECIFIC CORE COURSE (MINOR)						
COURSE	***SEMESTER***	***COURSE CODE***	***COURSE TITLE***	***PRACTICAL***		
				Credits	***PRACTICAL***	***Internal/External***
Certificate Course	**B.Sc. II**	***MIN MB-206-P***	***BASIC BACTERIOLOGY***	**1**	**30**	***25(15+10) Marks***
UNIT	***TOPIC* (30hr)**					

1. Study of bacterial structure by use of structural staining:
   A. Endospore staining: Snyder's modification of Dorner's method
   B. Cell wall staining: Dyer's method
   C. Capsule staining: Hiss's method OR Maneval's method
   D. Volutin granules staining: Albert's method
2. Use of special staining technique to study bacteria:
   A. Spirochete staining: Fontana's staining method
   B. Flagella staining – Leifson's method.
   C. Cytoplasmic membrane staining by victoria blue stain
   D. Nucleus staining- Feulgen's method.

References:

1. Patel R.J. and Patel R.K. (2016) Experimental microbiology Volume I, 9thEdition.Aditya,
2. Patel R.J. and Patel R.K. (2017) Experimental microbiology Volume II, 9th Edition. Aditya,
3. Cappuccino J.G. (2016) Microbiology; A Laboratory Manual, 11th Edition. Pearson Edication (Singapore) Pvt. Ltd., (ISBN: 978-9332535190)

KSKV Kachchh University, Bhuj - Kachchh

(Effective from June 2023-24 UNDER NEP-2020)

SEMESTER 2 :

COURSE TITLE: BASIC BACTERIOLOGY

B. Sc.: MICROBIOLOGY INTERNAL PRACTICAL ***MIN MB-206*-P**

Date: ***Place:*** ***Time: ___Hrs*** ***Total Marks: 15***

Ex.1. Study of bacterial structure by use of structural staining: 10/Marks

A. Endospore staining: Dorner's method

B. Cell wall staining: Dyer's method

C. Capsule staining: Hiss's method

D. Volutin granules staining: Albert's method

E. Spirochete staining: Fontana's staining method

F. Spirochete staining: Fontana's staining method

G. Flagella staining – Leifson's method.

H. Cytoplasmic membrane staining by victoria blue stain

I. Nucleus staining- Feulgen's method.

Ex. 2 Viva voce 02 Marks

Ex. 3 Journal 03 Marks

KSKV Kachchh University, Bhuj - Kachchh

(Effective from June 2023-24 UNDER NEP-2020)

SEMESTER 2:

COURSE TITLE: BASIC BACTERIOLOGY

B. Sc.: MICROBIOLOGY UNIVERSITY PRACTICAL ***MIN MB-206-P***

Date: ***Place:*** ***Time: ___Hrs*** ***Total Marks: 10***

Ex.1. Study of bacterial structure by use of structural staining: 05 Marks

A. Endospore staining: Dorner's method

B. Cell wall staining: Dyer's method

C. Capsule staining: Hiss's method

D. Volutin granules staining: Albert's method

E. Spirochete staining: Fontana's staining method

F. Spirochete staining: Fontana's staining method

G. Flagella staining – Leifson's method.

H. Cytoplasmic membrane staining by victoria blue stain

I. Nucleus staining- Feulgen's method.

Ex. 2 Spotting 1.5Marks

Ex. 3 Viva voce 02 Marks

Ex. 4 Journal 1.5 Marks

DETAILED SYLLABUS OF B.Sc. I YEAR FOR CERTIFICATE COURSE IN MICROBIOLOGY

KSKV Kachchh University, Bhuj - Kachchh

(Effective from June 2023-24 UNDER NEP-2020)

SEMESTER II:

COURSE TITLE: BASIC BACTERIOLOGY

(Course code: MDC MB-207) Credit: 3

DISCIPLINE SPECIFIC CORE COURSE (MULTIDISCIPLINARY)							
COURSE	***SEMESTER***	***COURSE CODE***	***COURSE TITLE***	***THEORY***			
				Credits	***Lectures***	***External***	***Internal***
Certificate Course	***B.Sc. II***	***MDC MB-207***	**BASIC BACTERIOLOGY**	**3**	**45**	***40 Marks***	***35 Marks***
UNIT	***TOPIC*** **(45hrs)**						

Course Outcomes (COs):

The main aspects of this paper are to describe the bacterial taxonomy and nomenclature, basic structure of typical prokaryotes and archaea. It focuses on important differences in structure between bacteria and archaea. Understand diversified nutritional requirements of microorganisms and their cultivation using various different media. It also focuses on bacterial and archaeal reproduction, cell cycle, growth curve and effect of various environmental factors on growth of microorganisms.

UNIT-I	**INTRODUCTION TO BACTERIAL TAXONOMY AND NOMENCLATURE**	**15 Hours**
	a. Principles of binomial system of nomenclature b. Introduction to different systems of bacterial classification, Haeckel's three kingdom concept, Whittaker's five kingdom concept, Six kingdom classification, Eight kingdom classification and Carl Woese system of classification c. Introduction to Bergey.s Manual of systematic bacteriology	
UNIT-II	**TYPICAL PROKARYOTIC ORGANIZATION**	**15 Hours**
	a. Shape, size and arrangement of bacteria. b. Structure of bacterial cell c. Surface appendages of bacteria: i. General nature, arrangement, structure and role of flagella, General nature and significance of pili, prosthecae and stalks ii. Surface layers of bacteria: General nature and significance of capsule and slime layer, bacterial cell wall, Cell membrane and Mesosomes iii. Bacterial cytoplasm and cell	

	organelles: Cytoplasm, cytoplasmic inclusions, nuclear material d. Bacterial endospore: Spore structure, sporulation and spore germination	
UNIT-III	**Microbes in Extreme Environment**	**15 Hours**
	Nature, special features of the thermophilic, methanogenic and halophilic Archaea; photosynthetic bacteria, Cyanobacteria some Archaea who live in extreme conditions like cold, and space.	

REFERENCE BOOKS:

1. Microbiology, Pelczar, M.J.chan, E.C.S., Krig, N.R., McGrow – Hill Book Co.
2. Microbiology by J.G. Black, 2002 3. Introduction to Microbiology by J.L.Ingraham and C.A.Ingraham, 2000 1.
3. Willey J.M., Sherwood L.M. and Woolverton C.J., (2017) Prescott's Microbiology, 10th Edition, McGraw - Hill Education, (ISBN: 978-981-3151- 26-0)
4. Willey J.M., Sherwood L.M. and Woolverton C.J., (2008) Prescott, Harley and Klein's Microbiology, 7th Edition, McGraw - Hill Education, (ISBN: 978- 007126727-4)
5. Medigan M., et al., (2015) Brock Biology of Microorganisms, 14th Edition, Pearson education Ltd., (ISBN: 978-1-292-01831-7)
6. Basic Bacteriology: Ritesh Tandel

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SEMESTER II:

COURSE TITLE: BASIC BACTERIOLOGY

Practical/Lab course (Course code: MDC MB-208-P) Credit: 1

DISCIPLINE SPECIFIC CORE COURSE (MULTIDISCIPLINARY)						
COURSE	***SEMESTER***	***COURSE CODE***	***COURSE TITLE***	***PRACTICAL***		
				Credits	***PRACTICAL***	***Internal/External***
Certificate Course	**B.Sc. II**	***MDC MB-208-P***	**Basic Bacteriology**	**1**	**30**	***25(15+10) Marks***
	TOPIC **(30hr)**					

1. Study of bacterial structure by use of structural staining:

   A. Endospore staining: Snyder's modification of Dorner's method

   B. Cell wall staining: Dyer's method

   C. Capsule staining: Hiss's method OR Maneval's method

   D. Volutin granules staining: Albert's method

2. Use of special staining technique to study bacteria:

   E. Spirochete staining: Fontana's staining method

   F. Flagella staining – Leifson's method.

   G. Cytoplasmic membrane staining by victoria blue stain

   H. Nucleusstaining- Feulgen's method.

References:

1. Patel R.J. and Patel R.K. (2016) Experimental microbiology Volume I, 9thEdition.Aditya,
2. Patel R.J. and Patel R.K. (2017) Experimental microbiology Volume II, 9th Edition. Aditya,
3. Cappuccino J.G. (2016) Microbiology; A Laboratory Manual, 11th Edition. Pearson Edication (Singapore) Pvt. Ltd., (ISBN: 978-9332535190)

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SEMESTER 2:

COURSE TITLE: BASIC BACTERIOLOGY

B. Sc.: MICROBIOLOGY INTERNAL PRACTICAL ***MDC MB-208*-P**

Date: ***Place:*** ***Time: ___Hrs*** ***Total Marks: 15***

Ex.1. Study of bacterial structure by use of structural staining: 10/Marks

A. Endospore staining: Dorner's method

B. Cell wall staining: Dyer's method

C. Capsule staining: Hiss's method

D. Volutin granules staining: Albert's method

E. Spirochete staining: Fontana's staining method

F. Spirochete staining: Fontana's staining method

G. Flagella staining – Leifson's method.

H. Cytoplasmic membrane staining by victoria blue stain

I. Nucleus staining- Feulgen's method.

Ex. 2 Viva voce 02 Marks

Ex. 3 Journal 03 Marks

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SEMESTER 2 :

COURSE TITLE: BASIC BACTERIOLOGY

B. Sc.: MICROBIOLOGY UNIVERSITY PRACTICAL ***MDC MB-208-P***

Date: ***Place:*** ***Time: ___Hrs*** ***Total Marks: 10***

Ex.1. Study of bacterial structure by use of structural staining: 07 Marks

A. Endospore staining: Dorner's method

B. Cell wall staining: Dyer's method

C. Capsule staining: Hiss's method

D. Volutin granules staining: Albert's method

E. Spirochete staining: Fontana's staining method

F. Spirochete staining: Fontana's staining method

G. Flagella staining – Leifson's method.

H. Cytoplasmic membrane staining by victoria blue stain

I. Nucleus staining- Feulgen's method.

Ex. 2 Spotting 1.5Marks

Ex. 3 Viva voce 02 Marks

Ex. 4 Journal 1.5 Marks