KRANTIGURU SHYAMJI KRISHNA VERMA KACHCHH UNIVERSITY,
BHUJ.

Year: 2025-2026

B.Sc (Honours) MICROBIOLOGY
(With Research /Without Research)

Semesters : V and VI
(Exit option)

FACULTY OF SCIENCE

SYLLABUS

Curriculum as per UGC Guideline
Framed according to National Education Policy (NEP) - 2020

KRANTIGURU SHYAMJI KRISHNA VERMA KACHCHH UNIVERSITY, BHUJ.

With effect from June – 2025 (and thereafter)

B.Sc. (Honours) MICROBIOLOGY Programme

(With Research/without Research)

NEP-2020

With effect from June – 2025 (and thereafter)

FACULTY OF SCIENCE

Subject: MICROBIOLOGY

B. Sc. Semesters: V & VI

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 secured for the Award
1	DEGREE in the Discipline	After successful completion of 1st Year	22
2	Diploma in the Discipline	After successful completion of 1st and 2nd Years	22
3	B.Sc. in Microbiology	After successful completion of 1st, 2nd and 3rd Years	22
4	B.Sc. (Honours with Research/ without Research) in Microbiology	After successful completion of 1st, 2nd, 3rd and 4th Years	22

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 DEGREE, diploma and degree, a student needs to fulfill the associated credits. An illustration of credit 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 citizens 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 a way 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. 5n 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. Year DEGREE COURSE

This DEGREE 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.
- Students shall produce competent Microbiologists 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.
- DEGREE 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 microorganisms 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.
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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 as each 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 participation.

2. The **End of Semester examination** (***External Evaluation***) shall have an assessment 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 CA	Marks UA	Total
Third Year	V	MJMB 501 (Theory)	**MOLECULAR GENETICS OF PROKARYOTES**	3	35	40	75
	V	MJMB 502-P (Practical)	As above (lab course)	1	15	10	25
	V	MJMB 503 (Theory)	**BACTERIAL METABOLISM**	3	35	40	75

V	MJMB 504-P (Practical)	As above (lab course)	1	15	10	25
V	MJMB 505 (Theory)	**PRINCIPLES OF IMMUNOLOGY**	3	35	40	75
V	MJMB 506-P (Practical)	As above (lab course)	1	15	10	25
		Total Credits	12	**Total Marks**		300
V	MNMB507 -A (Theory)	**Fundamentals Of Microscopy**	3	35	40	75
V	MNMB 508-P-A (Practical)	As above (lab course)	1	15	10	25
V	MNMB507 -B (Theory)	**Biophysics & Instrumentation**	3	35	40	75
V	MNMB 508-P-B (Practical)	As above (lab course)	1	15	10	25
V	MNMB509 -A (Theory)	**SOIL AND WATER MICROBIOLOGY**	3	35	40	75
V	MNMB 510-P-A (Practical)	As above (lab course)	1	15	10	25
V	MNMB509 -B (Theory)	**BIOSTATISTICS**	3	35	40	75
V	MNMB 510B-P (Practical)	As above (lab course)	1	15	10	25
		TOTAL CREDITS	8	Total Marks		200
V	SECMB 511-P	**Biopesticide and Biocontrol**	2	25	25	50

	VI	MJMB 601 (Theory)	**BIOPROCESS TECHNOLOGY**	3	35	40	75
	VI	MJMB 602-P (Practical)	As above (lab course)	1	15	10	25
	VI	MJMB 603 (Theory)	**VIROLOGY AND MYCOLOGY**	3	35	40	75
	VI	MJMB 604-P (Practical)	As above (lab course)	1	15	10	25
	VI	MJMB 605 (Theory)	**MEDICAL MICROBIOLOGY**	3	35	40	75
	VI	MJMB 606-P (Practical)	As above (lab course)	1	15	10	25
			Total Credits	12	**Total Marks**		**300**
	VI	MIN MB 607-A (Theory)	**Nutrition And Growth of Bacteria**	3	35	40	75
	VI	MIN MB 608-P-A (Practical)	As above (lab course)	1	15	10	25
	VI	MIN MB 607-B (Theory)	**Environmental Microbiology**	3	35	40	75
	VI	MIN MB 608-P-B (Practical)	As above (lab course)	1	15	10	25
				4	**Total Marks**		100
	IV	INTMB609	**INTERNSHIP**	4	50	50	100

The Structure of the Question Paper for the University Theory Exam MJ/MN/ MB-501/503/505/507/509/601/603/605/607

Total Marks : 40

Total No. of Questions : 04

Questions	Section	Marks
Question – 1	**(Descriptive - Essay type – Short**	**10 marks**
Unit – I	**notes *with internal option) 2 out of 3***	
Question – 2	**–do-**	**10 marks**
Unit –II		
Question – 3	**–do-**	**10 marks**
Unit – III		
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. 5 YEAR FOR DEGREE COURSE IN MICROBIOLOGY

KSKV Kachchh University, Bhuj - Kachchh

(Effective from June 2025-26 UNDER NEP-2020)

SEMESTER 5:

COURSE TITLE: MOLECULAR GENETICS OF PROKARYOTES

(Course code: MJMB 501) Credit: 3

DISCIPLINE SPECIFIC CORE COURSES (MAJOR)							
COURSE	*SEMESTER*	*COURSE CODE*	*COURSE TITLE*	*THEORY*			
				Credits	*Lectures*	*External*	*Internal*
DEGREE COURSE	*B.Sc. V*	*MJMB-501*	**MOLECULAR GENETICS OF PROKARYOTES**	**3**	**45**	***40 Marks***	***35 Marks***

Course Outcomes (COs):

Upon completing these topics, students will be able to: describe the structure and organization of genomes, explain the mechanisms of DNA replication, and understand the significance of genome organization and DNA replication; describe the structure and function of genes, explain the mechanisms of gene regulation, and understand the processes of transcription and translation.

UNIT-I	**Genome Organization and DNA Replication: Fundamental Concepts**

	1. Terms and characteristics of genetic material 2. Early studies of DNA [Chargaff 's rules, The discovery of the transforming principle (Griffith's experiments), Identification of the transforming principle (Avery, MacLeod, and McCarty's experiment), The Hershey–Chase experiment] 3. Watson and Crick Model (X-ray diffraction, Three-Dimensional Structure of DNA) 4. Primary structure of DNA (Nucleotides, Polynucleotide strands) 5. Secondary Structures of DNA (DNA polynucleotide strand, The double helix, DNA polynucleotide strand) 6. Different secondary structures (A, B and Z form) 7. Prokaryotic replication a. Proposed models of replication (Conservative replication, Dispersive replication, and b. Semi-conservative replication) c. Meselson and Stahl's Experiment d. Models of replication (Theta replication, Rolling circle replication, Linear replication) e. Direction of replication (Continuous and Discontinuous, Okazaki fragment) f. Required enzymes and proteins in bacterial replication. g. Bacterial replication (Initiation, Elongation and Termination)
UNIT-II	**From Gene to mRNA: Structure, Regulation, Transcription**
	1. Prokaryotic transcription a. Gene structure and function, b. Primary and secondary structure of RNA c. Transcription University. d. The transcription apparatus (Bacterial RNA Polymerase) e. The Process of Bacterial Transcription [Initiation (Bacterial promoters, Initial RNA synthesis), Elongation (The transcription bubble, Transcriptional pausing, Accuracy of transcription), Termination (Rho dependent and Rho independent terminators)] f. Concept of operon, Regulation and expression of genes in prokaryotes (*lac*, *trp* and *ara* operon) 2. The genetic code and translation in prokaryotes a. One gene, one enzyme hypothesis b. The degeneracy of the code c. The reading frame, initiation codon and termination codons. d. The universality of the code.

	e. The binding of amino acids to transfer RNAs f. Three-dimensional structure of ribosome and polyribosomes g. The process of bacterial translation (Initiation, Elongation, Termination)
UNIT-III	Mechanisms of Genetic Variation
	1. Bacterial Conjugation a. $F^+ x\ F^-$ Mating b. Hfr Conjugation c. F' Conjugation 2. Bacterial Transformation a. Transformation with DNA Fragments b. Transformation with Plasmid c. Bacterial Transformation in *S.pneumoniae, H. influenzae and B.subtilis.* 3. Transduction a. Generalized Transduction b. Specialized Transduction 4. Development of Antibiotic Resistance in Bacteria a. Mechanism of Drug resistance b. The Origin and Transmission of Drug Resistance

REFERENCE BOOKS:

1. Dale, J. W., von Schantz, M., & Plant, N. (2011). *From genes to genomes: Concepts and applications of DNA technology* (3rd ed.). Wiley-Blackwell.
2. Griffiths, A. J. F., Wessler, S. R., Lewontin, R. C., Gelbart, W. M., Suzuki, D. T., & Miller, J. H. (2005). *An introduction to genetic analysis* (8th ed.). W. H. Freeman.
3. Hartl, D. L., & Jones, E. W. (1998). *Genetics: Principles and analysis* (4th ed.). Jones & Bartlett Publishers.
4. Jocelyn E. Krebs, Elliott S. Goldstein, & Stephen T. Kilpatrick. (2014). *Lewin's GENES XI.* Jones & Bartlett Learning.
5. Rastogi, V. (Rev. & enl. 2nd ed.). (Year). *Principles of molecular biology.*
6. Pierce, B. A. (2012). *Genetics: A conceptual approach* (4th ed.). W. H. Freeman
7. Verma, P. S., & Agarwal, V. K. (Year). *Cell biology, genetics, molecular biology, evolution and ecology.* [Publisher].
8. Watson, J. D., Baker, T. A., Bell, S. P., Gann, A., Levine, M., & Losick, R. (2013). *Molecular biology of the gene* (7th ed.). Pearson.
9. Willey, J. M., Sherwood, L. M., & Woolverton, C. J. (2016). *Prescott's microbiology* (10th ed.). McGraw-Hill Education.

KSKV Kachchh University, Bhuj - Kachchh
(Effective from June 2025-26 UNDER NEP-2020)
SEMESTER 5:
Course Title: MOLECULAR GENETICS OF PROKARYOTES
Practical/ Lab course (Course code: MJMB 502-P) Credit: 2

DISCIPLINE SPECIFIC CORE COURSE (MAJOR)						
COURSE	*SEMESTER*	*COURSE CODE*	*COURSE TITLE*	*PRACTICAL*		
				Credits	*PRACTICAL*	*INTERNAL /External*
DEGREE COURSE	**B.Sc. V**	*MJMB-502-P*	**MOLECULAR GENETICS OF PROKARYOTES**	**1**	**30**	*25(15+10)Marks*
	***TOPIC* (30hr)**					

1. Isolation of *lac*- mutants of *Escherichia coli* using UV radiations as mutagen
2. Isolation of pigment less mutant of *Serratia marcescens* using UV radiations as mutagen
3. Isolation of streptomycin resistant mutants of *Escherichia coli* by gradient plate method
4. Determination of absorption spectra of DNA using UV-Visible spectrophotometer.
5. Estimation of DNA by diphenylamine reaction.

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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(Effective from June 2025-26 UNDER NEP-2020)
SEMESTER 5:
COURSE TITLE: MOLECULAR GENETICS OF PROKARYOTES
B. Sc.: MICROBIOLOGY INTERNAL PRACTICAL ***MJMB-502P***

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

Ex 1. A. Isolation of *lac*- mutants of *Escherichia coli* using UV radiations as mutagen
B. Isolation of pigment less mutant of *Serratia marcescens* using UV radiations as mutagen
C. Isolation of streptomycin resistant mutants of *Escherichia coli* by gradient plate method
D. Determination of absorption spectra of DNA using UV-Visible spectrophotometer.
E. Estimation of DNA by diphenylamine reaction. 05Marks
Ex 2 Spotting 05Marks
Ex 3 Viva voce 02 Marks
Ex 4 Journal 03 Marks

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(Effective from June 2025-26 UNDER NEP-2020)
SEMESTER 5:
COURSE TITLE: MOLECULAR GENETICS OF PROKARYOTES
B. Sc. : MICROBIOLOGY UNIVERSITY PRACTICAL ***MJMB-502-P***

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

Ex 1. A. Isolation of *lac*- mutants of *Escherichia coli* using UV radiations as mutagen
B. Isolation of pigment less mutant of *Serratia marcescens* using UV radiations as mutagen
C. Isolation of streptomycin resistant mutants of *Escherichia coli* by gradient plate method
D. Determination of absorption spectra of DNA using UV-Visible spectrophotometer.
E. Estimation of DNA by diphenylamine reaction. 05Marks
Ex 2 Spotting 02Marks
Ex 3 Viva voce 01 Marks
Ex 4 Journal 02 Marks

KSKV Kachchh University, Bhuj - Kachchh
DETAILED SYLLABUS OF B.Sc. 5 YEAR FOR DEGREE COURSE IN MICROBIOLOGY
(Effective from June 2025-26 UNDER NEP-2020)
SEMESTER 5:
COURSE TITLE: BACTERIAL METABOLISM
(Course code: MJMB 503) Credit: 3

DISCIPLINE SPECIFIC CORE COURSES (MAJOR)							
COURSE	*SEMESTER*	*COURSE CODE*	*COURSE TITLE*	*THEORY*			
				Credits	*Lectures*	*External*	*Internal*
DEGREE COURSE	*B.Sc.V*	*MJMB-503*	**BACTERIAL METABOLISM**	**3**	**45**	*40 Marks*	*35 Mark*

Course Outcomes (COs):

Upon successful completion of this paper students will learn about Fundamentals of microscopy concept like Students will learn to understand the BACTERIAL METABOLISM To learn Chemotrophic metabolism, Phototrophic metabolism and Biosynthesis of Biomolecules .

UNIT-I	**Chemotrophic Metabolism**	**15 Hours**
	1. Catabolism of glucose A. Pathways of glucose degradation: EMP, ED & PP pathway 2. Tricarboxylic acid (TCA) cycle A. Catabolic role of TCA cycle 3. Catabolism of fatty acids A. β-oxidation of fatty acids	
UNIT-II	**Phototrophic metabolism**	**15 Hours**
	1. Phototrophic metabolism A. Photosynthetic apparatus in photosynthetic eubacteria, cyclic and noncyclic photophosphorylation B. Photophosphorylation in halobacteria C. Pathways for CO2 fixation i. Calvin cycle, ii. Reductive TCA cycle	

UNIT-III	Biosynthesis	15 Hours
	1. Biosynthesis of A. Amino acids B. Nucleotides C. Fatty acids and lipids D. Biosynthesis of peptidoglycan	

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. Microbiology by Prescott, Parley, Klein. 7th edition, 2008

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(Effective from June 2025-26 UNDER NEP-2020)
SEMESTER 5:
COURSE TITLE: BACTERIAL METABOLISM
Practical/ Lab course (Course code: MAJ MB 304-P) Credit: 2

DISCIPLINE SPECIFIC CORE COURSE (MAJOR)						
COURSE	*SEMESTER*	*COURSE CODE*	*COURSE TITLE*	*PRACTICAL*		
				Credits	*HRS*	*Internal/External*
DEGREE COURSE	**B.Sc. 5**	*MJMB-504-P*	*BACTERIAL METABOLISM*	**1**	**30**	*25(15+10) Marks*
	TOPIC **(30hr)**					

1. Estimation of glucose by Cole's method
2. Estimation of glucose by Nelson-Somogy's method
3. Estimation of protein by Folin-Lawry's method
4. Estimation of streptomycin by sodium nitroprusside 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)
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 5:
COURSE TITLE: *BACTERIAL METABOLISM*
B. Sc.: MICROBIOLOGY INTERNAL PRACTICAL ***MAJ MB-504P***

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

Ex.1 . 1. Estimation of glucose by Cole's method 05 Marks
2. Estimation of glucose by Nelson-Somogy's method
3. Estimation of protein by Folin-Lawry's method
4. Estimation of streptomycin by sodium nitroprusside method

Ex 2 Viva voce 02 Marks
Ex 3 Journal 03 Marks
Ex 4 Spotting 05 Marks

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SEMESTER 5:
COURSE TITLE: *BACTERIAL METABOLISM*
B. Sc.: MICROBIOLOGY UNIVERSITY PRACTICAL ***MAJ MB-504-P***

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

Ex.1 . 1. Estimation of glucose by Cole's method 05 Marks
2. Estimation of glucose by Nelson-Somogy's method
3. Estimation of protein by Folin-Lawry's method
4. Estimation of streptomycin by sodium nitroprusside method

Ex. 2 Spotting 1.5 Marks
Ex. 3 Viva voce 02 Marks
Ex. 4 Journal 1.5 Marks

DETAILED SYLLABUS OF B.Sc. 3 YEAR FOR DEGREE COURSE IN MICROBIOLOGY

KSKV Kachchh University, Bhuj - Kachchh
(Effective from June 2025-26 UNDER NEP-2020)
SEMESTER 5:
COURSE TITLE: PRINCIPLES OF IMMUNOLOGY
(Course code: MAJ MB 505) Credit: 3

DISCIPLINE SPECIFIC CORE COURSES (MINOR)							
COURSE	*SEMESTER*	*COURSE CODE*	*COURSE TITLE*	*THEORY*			
				Credits	*Lectures*	*External*	*Internal*
DEGREE COURSE	*B.Sc. V*	*MAJMB-505*	**PRINCIPLES OF IMMUNOLOGY**	**3**	**45**	*40 Marks*	*35 Marks*

Course Outcomes (COs):

Upon successful completion of these paper students will learn about SOIL AND WATER MICROBIOLOGY concept like Students will learn about the microbiology of soil **microorganisms as biogeochemical agents,**

UNIT-I	**Immunity and Immune response**	**15 Hours**
	1. Immunity A. Types of immunity B. Innate immunity: species, racial and individual C. Acquired immunity: active and passive; natural and artificial D. Concept of herd immunity 2. Immune response (IR) A. Concept and basic functions of IR, two arms (branches) of IR: Antibody mediated (humoral) and cell mediated immune (CMI). B. Primary and secondary IR 3. Cells and organs of immune system A. Importance of antigen presenting cells in IR B. An introduction to the primary (central) and secondary (peripheral) lymphoid organs C. Monoclonal antibodies	

UNIT-II	**Antigens and Antibodies and their Reaction**	**15 Hours**
	1. Antigens A. Concept of antigen, immunogen and hapten B. Physico-chemical and biological properties of antigens C. Various types of antigens D. Antigens occurring in bacterial cell 2. Antibodies A. Basic structure of antibodies B. Classes of immunoglobulins: Physicochemical and biological properties C. Antibody diversity	
UNIT-III	**Immune Complex Reaction**	**15 Hours**
	1. Mechanism of antigen-antibody reactions (zone phenomenon); Concept of lattice formation 2. Principles and applications antigen-antibody reactions i. Precipitin reaction ii. Agglutination reaction iii. Complement fixation reaction iv. Immunofluorescence v. Enzyme Linked Immunosorbent Assay (ELISA) vi. Radio Immunoassay (RIA); Radio-Allergen-Sorbent test (RAST) vii. Western blot technique	

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. Microbial Ecology, R Campbell. Johan Wiley and Sons.
5. Introduction to Microbial World: Ritesh Tandel, Komal Chawda & Kalpesh Sorthia.
6. Atlas R M, (1997), ***Principles of Microbiology***. 2nd edn, Wm. C. Brown Pub.,Iowa, USA.
7. Prescott L, Harley J P, and Klein D A, (2008), ***Microbiology***, 7th edn. Wm C. Brown - McGraw Hill, Dubuque, IA.

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(Effective from June 2025-26 UNDER NEP-2020)

SEMESTER 5:

COURSE TITLE: PRINCIPLES OF IMMUNOLOGY

Practical/ Lab course (Course code: MAJMB 506-P) Credit: 1

DISCIPLINE SPECIFIC CORE COURSE (MINOR)						
COURSE	*SEMESTER*	*COURSE CODE*	*COURSE TITLE*	*PRACTICAL*		
				Credits	*PRACTICAL*	*INTERNAL/External*
DEGREE COURSE	**B.Sc. V**	*MJMB-506-P*	**PRINCIPLES OF IMMUNOLOGY**	**1**	**30**	***25(15+10) Marks***
	***TOPIC*(30hr)**					

1. Study of agglutination reaction: Widal test by slide agglutination and double dilution method
2. Determination of human blood group: ABO and Rh systems
3. Estimation of hemoglobin by Sahli's acid hematin method
4. Total count of erythrocytes and leucocytes
5. Differential count of leucocytes by Field'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)
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 2025-26 UNDER NEP-2020)
SEMESTER 5:
Course Title: PRINCIPLES OF IMMUNOLOGY
B. Sc.: MICROBIOLOGY INTERNAL PRACTICAL **MAJ*MB-506*P**

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

EX-1. Study of agglutination reaction: Widal test by slide agglutination and double dilution method 05 Marks
2. Determination of human blood group: ABO and Rh systems
3. Estimation of hemoglobin by Sahli's acid hematin method
4. Total count of erythrocytes and leucocytes
5.Differential count of leucocytes by Field's method
Ex 2 Spotting 05Marks
Ex 3 Viva voce 02 Marks
Ex 4 Journal 03 Marks

KSKV Kachchh University, Bhuj - Kachchh
(Effective from June 2025-26 UNDER NEP-2020)
SEMESTER 5:
Course Title: PRINCIPLES OF IMMUNOLOGY
B. Sc.: MICROBIOLOGY UNIVERSITY PRACTICAL ***MAJMB-506-P***

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

EX-1 Study of agglutination reaction: Widal test by slide agglutination and double dilution method 05 Marks
2. Determination of human blood group: ABO and Rh systems
3. Estimation of hemoglobin by Sahli's acid hematin method
4. Total count of erythrocytes and leucocytes
5. Differential count of leucocytes by Field's method

Ex.2. Spotting 1.5 Marks
Ex 3. Viva voce 02Marks
Ex 4 Journal & 1.5 Marks

DETAILED SYLLABUS OF B.Sc. 3 YEAR FOR DEGREE COURSE IN MICROBIOLOGY
KSKV Kachchh University, Bhuj - Kachchh
(Effective from June 2025-26 UNDER NEP-2020)
SEMESTER 5:
COURSE TITLE: FUNDAMENTALS OF MICROSCOPY
(Course code: MNMB 507-A) Credit: 3

DISCIPLINE SPECIFIC CORE COURSES (MAJOR)							
COURSE	*SEMESTER*	*COURSE CODE*	*COURSE TITLE*	*THEORY*			
				Credits	*Lectures*	*External*	*Internal*
DEGREE COURSE	*B.Sc. 5*	*MNMB-507-A*	FUNDAMENTALS OF MICROSCOPY	3	45	*40 Marks*	*35 Marks*

Course Outcomes (COs):

Upon successful completion of these paper students will learn about Fundamentals of microscopy concepts 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 cry tomography** **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)
10.Introduction to Microbial World :Ritesh Tandel, Komal Chawda & Kalpesh Sorthia.

KSKV Kachchh University, Bhuj - Kachchh
(Effective from June 2025-26 UNDER NEP-2020)
SEMESTER 5:
COURSE TITLE: FUNDAMENTALS OF MICROSCOPY
Practical/ Lab course (Course code: MNMB 508-A-P) Credit: 2

COURSE	*SEMESTER*	*COURSE CODE*	*COURSE TITLE*	*PRACTICAL*		
				Credits	*PRACTICAL*	*Internal/External*
DEGREE COURSE	B.Sc. 5	*MNMB-508-P-A*	*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)
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 2025-26 UNDER NEP-2020)
SEMESTER 5:
COURSE TITLE: FUNDAMENTALS OF MICROSCOPY
B. Sc.: MICROBIOLOGY INTERNAL PRACTICAL *MNMB-508-A-P*

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**

KSKV Kachchh University, Bhuj - Kachchh
(Effective from June 2025-26 UNDER NEP-2020)
SEMESTER 5:
COURSE TITLE: FUNDAMENTALS OF MICROSCOPY
B. Sc.: MICROBIOLOGY UNIVERSITY PRACTICAL *MNMB-508-A-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. 3 YEAR FOR DEGREE COURSE IN MICROBIOLOGY
KSKV Kachchh University, Bhuj - Kachchh
(Effective from June 2025-26 UNDER NEP-2020)
SEMESTER 5:
COURSE TITLE: BIOPHYSICS & INSTRUMENTATION
(Course code: MNMB 507-B) Credit: 3

DISCIPLINE SPECIFIC CORE COURSES (MAJOR)							
COURSE	*SEMESTER*	*COURSE CODE*	*COURSE TITLE*	*THEORY*			
				Credits	*Lectures*	*External*	*Internal*
DEGREE COURSE	*B.Sc. 5*	*MNMB-507-B*	**BIOPHYSICS & INSTRUMENTATION**	**3**	**45**	*40 Marks*	*35 Marks*

Course Outcomes (COs):

Upon successful completion of these paper students will learn about Fundamentals of microscopy concepts like Students will learn to understand the fundamentals of microscopy To learn different types of Instruments and its application in Microbiology.

UNIT-I	**Spectroscopy**	**15 Hours**
	➢ Electromagnetic Radiation: ➢ UV-Visible spectroscopy, ➢ Atomic Absorption Spectroscopy ➢ Atomic Emission Spectroscopy, ➢ Infrared (IR) Spectroscopy ➢ Magnetic Resonance (NMR), ➢ Electron Spin Resonance (ESR) ➢ X-ray Diffraction (XRD) and Crystallography	
UNIT-II	**Centrifugation & Electrophoresis**	**15 Hours**
	➢ Centrifugation: Basic principles; Settling time and velocity, Types of rotor, Sedimentation coefficient, RCF; ➢ Types of centrifuges Preparative centrifugation & Analytical centrifugation Electrophoresis: Basic Principles of electrophoresis; Support Media; Modes of ➢ Electrophoresis Electrophoretic methods for Nucleic Acid Analysis: Agarose gel electrophoresis, Pulsed field, Gel	

	electrophoresis, Polyacrylamide gel electrophoresis (PAGE), Denaturing PAGE ➢ Electrophoretic methods for Protein Analysis: SDS-PAGE, Gradient gel, Isoelectric focusing, (2D Electrophoresis),High/Low voltage electrophoresis, Capillary electrophoresis; Disc gel electrophoresis	
UNIT-III	**Chromatography Techniques**	**15 Hours**
	➢ Chromatography: Theory and principles. ➢ Definition of key terms: Retention time, Peak shape, Band broadenings, Column efficiency, Theoretical plate model (HETP), Rate Theory, Resolution, Selectivity. ➢ Partition theory: Retention &differential migration mechanism, Equilibrium between two phases, Properties of solvents (MP), Stationary phase and Supporting phase. ➢ Planar &Column Chromatography: TLC, HPTLC, Paper chromatography, Normal and Reverse-phase, Gel permeation, Ion exchange, Adsorption, Partition and Affinity chromatography. ➢ Analytical Chromatography: Quantitative Biochemical Measurements, GC/ GLC, HPLC, UHPLC and FPLC, GC-MS, LC-MS Criteria of protein purity.	

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. Sambrook, J., Fritsch, E. F., &Maniatis, T. (1989). Molecular cloning (Vol. 2, pp. 14-9). New York: Cold spring harbor laboratory press.
5. Blau, K., & King, G. S. (Eds.). (1993). Handbook of derivatives for chromatography (Vol. 2). New York: Wiley.
6.Kindt, T. J., Goldsby, R. A., Osborne, B. A., &Kuby, J. (2007). Kuby immunology. Macmillan.
7. Hayat, M. A. (1974). Principles and techniques of scanning electron microscopy. Biological applications. Volume 1. Van Nostrand Reinhold Company
8. .Introduction to Microbial World :Ritesh Tandel, Komal Chawda & Kalpesh Sorthia.

KSKV Kachchh University, Bhuj - Kachchh
(Effective from June 2025-26 UNDER NEP-2020)
SEMESTER 5:
COURSE TITLE: BIOPHYSICS & INSTRUMENTATION
Practical/ Lab course (Course code: MNMB 508-B-P) Credit: 2

COURSE	*SEMESTER*	*COURSE CODE*	*COURSE TITLE*	*PRACTICAL*		
				Credits	*PRACTICAL*	*Internal/External*
DEGREE COURSE	**B.Sc. 5**	*MNMB-508-P-A*	**BIOPHYSICS & INSTRUMENTATION**	**1**	**30**	*25(15+10)Marks*
	TOPIC **(30hr)**					

1. Principle and operation of UV-Visible spectroscopy, Atomic Absorption Spectroscopy &Atomic Emission Spectroscopy, Infrared (IR) Spectroscopy and Raman Spectroscopy, Mass spectrometry (MALDI-TOF), Magnetic Resonance (NMR), Electron Spin Resonance (ESR)., X-ray Diffraction (XRD) and Crystallography, CD, ORD Spectroscopy
2. Principle and operation of Centrifugation
3. Principle and operation of Electrophoresis
4. Principle and operation of GC/ GLC, HPLC, UHPLC and FPLC, GC-MS, LC-MS

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 2025-26 UNDER NEP-2020)
SEMESTER 5:
COURSE TITLE: BIOPHYSICS & INSTRUMENTATION
B. Sc.: MICROBIOLOGY INTERNAL PRACTICAL *MNMB-508-B--P*

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

Ex.1 Principle and operation of UV-Visible spectroscopy, Atomic Absorption Spectroscopy &Atomic Emission Spectroscopy, Infrared (IR) Spectroscopy and Raman Spectroscopy, Mass spectrometry (MALDI-TOF), Magnetic Resonance (NMR), Electron Spin Resonance (ESR)., X-ray Diffraction (XRD) and Crystallography, CD, ORD Spectroscopy (05 Marks)

2. Principle and operation of Centrifugation
3. Principle and operation of Electrophoresis
4. Principle and operation of GC/ GLC, HPLC, UHPLC and FPLC, GC-MS, LC-MS

Ex 2 Viva voce **02 Marks**
Ex 3 Journal **03 Marks**
Ex 4 Spotting **05 Marks**

KSKV Kachchh University, Bhuj - Kachchh
(Effective from June 2025-26 UNDER NEP-2020)
SEMESTER 5:
COURSE TITLE: BIOPHYSICS & INSTRUMENTATION
B. Sc.: MICROBIOLOGY UNIVERSITY PRACTICAL *MNMB-508-B--P*

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

Ex.1 Principle and operation of UV-Visible spectroscopy, Atomic Absorption Spectroscopy &Atomic Emission Spectroscopy, Infrared (IR) Spectroscopy and Raman Spectroscopy, Mass spectrometry (MALDI-TOF), Magnetic Resonance (NMR), Electron Spin Resonance (ESR)., X-ray Diffraction (XRD) and Crystallography, CD, ORD Spectroscopy (05 Marks)

2. Principle and operation of Centrifugation
3. Principle and operation of Electrophoresis
4. Principle and operation of GC/ GLC, HPLC, UHPLC and FPLC, GC-MS, LC-MS

Ex. 2 Spotting **1.5 Marks**
Ex. 3 Viva voce **02 Marks**
Ex. 4 Journal **1.5 Marks**

DETAILED SYLLABUS OF B.Sc. 5 YEAR FOR DEGREE COURSE IN MICROBIOLOGY

KSKV Kachchh University, Bhuj - Kachchh

(Effective from June 2025-26 UNDER NEP-2020)

SEMESTER 5:

COURSE TITLE: SOIL AND WATER MICROBIOLOGY

(Course code: MNMB 509-A) Credit: 3

DISCIPLINE SPECIFIC CORE COURSES (MINOR)							
COURSE	*SEMESTER*	*COURSE CODE*	*COURSE TITLE*	*THEORY*			
				Credits	*Lectures*	*External*	*Internal*
DEGREE COURSE	*B.Sc. V*	*MNMB-509*	**SOIL AND WATER MICROBIOLOGY**	**3**	**45**	***40 Marks***	***35 Marks***

Course Outcomes (COs):

Upon successful completion of these paper students will learn about SOIL AND WATER MICROBIOLOGY concept like Students will learn about the microbiology of soil **microorganisms as biogeochemical agents,**

UNIT-I	**MICROBIOLOGY OF SOIL**	**15 Hours**
	1. Soil as a culture medium - Physicochemical characteristics of soil 2. Soil microflora: Diversity in soil microflora 3. Methods of studying soil microflora: a. Direct microscopic method, Agar plate technique, Enrichment culture technique and Buried slide method. b. Use of Winogradsky column in studying microbial diversity in soil 4. Microbial interactions in soil: a. Neutral, Positive & Negative associations b. Interaction between plant roots and microorganisms: i. Rhizosphere and its significance, ii. Mycorrhiza and root nodule formation	
UNIT-II	**MICROORGANISMS AS BIOGEOCHEMICAL AGENTS**	**15 Hours**

	1. Introduction to biogeochemical transformations in soil – mineralization and immobilization of elements 2. Rotation of elements in nature a. Nitrogen cycle – Proteolysis, ammonification, nitrification, denitrification and nitrogen fixation b. Sulfur cycle - Sulfur oxidation and reduction c. Carbon cycle – Degradation of complex organic compounds, carbon dioxide fixation, Humus and its significance d. Iron cycle – Iron oxidation and reduction e. Phosphorus cycle – Mineralization, immobilization and solubilization of Phosphorus	
UNIT-III	**MICROBIOLOGY OF DRINKING WATER**	**15 Hours**
	1. Natural waters – sources of contamination 2. Microbial indicators of fecal pollution- coliforms and other than coliforms. 3. Nuisance organisms in water: Slime forming bacteria, Iron & Sulfur bacteria and Algae 4. Bacteriological examination of drinking water- qualitative and quantitative 5. Purification of drinking water: Sedimentation, Filtration and Disinfection 6. Types of wastewaters, Chemical and Microbiological characteristics of waste water. BOD, COD & TOD as indicators of strength of wastewater. 7. Wastewater treatment: Primary, secondary, tertiary	

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 2025-26 UNDER NEP-2020)
SEMESTER 5:
COURSE TITLE: SOIL AND WATER MICROBIOLOGY
Practical/ Lab course (Course code: MNMB 510A-P) Credit: 2

DISCIPLINE SPECIFIC CORE COURSE (MINOR)						
COURSE	*SEMESTER*	*COURSE CODE*	*COURSE TITLE*	*PRACTICAL*		
				Credits	*PRACTICAL*	*INTERNAL/External*
DEGREE COURSE	**B.Sc. 5**	*MNMB-510A-P*	**SOIL AND WATER MICROBIOLOGY**	**1**	**30**	*25(15+10)Mar*
	***TOPIC*(30hr)**					

1. Microbiological analysis of soil
a. Standard plate count of Rhizosphere and non rhizosphere soil
b. Isolation of symbiotic and non-symbiotic nitrogen fixing bacteria and actinomycetes from soil
2. Microbiological analysis of drinking water
a. Standard plate count of drinking water
b. Detection of fecal pollution of water by performing presumptive test, confirmed test and completed test.
c. Determination of MPN of coli forms in water.

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 2025-26 UNDER NEP-2020)

SEMESTER 5:

Course Title: SOIL AND WATER MICROBIOLOGY

B. Sc.: MICROBIOLOGY INTERNAL PRACTICAL **MN*MB-510A* P**

Date: **Place:** **Time: ____Hrs -** **Total Marks: 15**

EX-1 Microbiological analysis of Soil / water (Any one) 05 Marks

1. Standard plate count of water / soil sample
2. Determination of MPN for coli forms in water sample
3. Presumptive and confirmed test for water
4. Confirmed and completed test for water
5. Isolation of symbiotic and non-symbiotic nitrogen fixing bacteria and actinomycetes from soil

Ex 2 Spotting 05Marks

Ex 3 Viva voce 02 Marks

Ex 4 Journal 03 Marks

KSKV Kachchh University, Bhuj - Kachchh

(Effective from June 2025-26 UNDER NEP-2020)

SEMESTER 5:

Course Title: SOIL AND WATER MICROBIOLOGY

B. Sc.: MICROBIOLOGY UNIVERSITY PRACTICAL ***MNMB-510A-P***

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

EX-1 Microbiological analysis of Soil / water (Any one) 05 Marks

1. Standard plate count of water / soil sample
2. Determination of MPN for coli forms in water sample
3. Presumptive and confirmed test for water
4. Confirmed and completed test for water
5. Isolation of symbiotic and non-symbiotic nitrogen fixing bacteria and actinomycetes from soil

Ex.2. Spotting 1.5 Marks

Ex 3. Viva voce 02Marks

Ex 4 Journal & 1.5 Marks

DETAILED SYLLABUS OF B.Sc. 5 YEAR FOR DEGREE COURSE IN MICROBIOLOGY

KSKV Kachchh University, Bhuj - Kachchh

(Effective from June 2025-26 UNDER NEP-2020)

SEMESTER 5:

COURSE TITLE: BIOSTATISTICS

(Course code: MNMB 509-B) Credit: 3

DISCIPLINE SPECIFIC CORE COURSES (MINOR)							
COURSE	*SEMESTER*	*COURSE CODE*	*COURSE TITLE*	*THEORY*			
				Credits	*Lectures*	*External*	*Internal*
DEGREE COURSE	*B.Sc. V*	*MNMB-509B*	**BIOSTATISTICS**	**3**	**45**	*40 Marks*	*35 Marks*

Course Outcomes (COs):		
Upon successful completion of these paper students will learn about SOIL AND WATER MICROBIOLOGY concept like Students will learn about the microbiology of soil **microorganisms as biogeochemical agents,**		
UNIT-I	Introduction to Biostatistics	**15 Hours**
	➢ Basic definitions and applications. Sampling: Representative sample, sample size, sampling biasand sampling techniques. ➢ Data collection and presentation: Types of data, methods of collection of primary and secondarydata, ➢ Methods of data presentation, graphical representation by histogram, polygon, ogive curves and pie diagram	
UNIT-II	Measures of central tendency	**15 Hours**
	➢ Measures of central tendency: Mean, Median, Mode. Measures of variability: Standard deviation, standard error, range, mean deviation and coefficient of variation, skewness, ➢ Karl Pearsons co-efficient Boleys of skewness, kurtosis	

UNIT-III	Tests of significance	15 Hours
	➢ Test of hypothesis ➢ Correlation and regression: ➢ Introduction to probability theory and distributions, (concept without deviation) binomial, poison and normal (only definitions and problems)	

REFERENCE BOOKS:

1. Statistics in biology, Vol. 1 by Bliss, C.I.K. (1967) Mc Graw Hill, NewYork.
2. Practical Statistics for experimental biologist by Wardlaw, A.C. (1985).
3. Statistical Methods in Biology - 2000 by Bailey, N.T. J. English Univ. Press.
4. Biostatistics - 7th Edition by Daniel
5. Fundamental of Biostatistics by Khan
6. Biostatistical Methods by Lachin
7. Statistics for Biologist by Campbell R.C. (1974) Cambridge University Press, UK

KSKV Kachchh University, Bhuj - Kachchh

(Effective from June 2025-26 UNDER NEP-2020)

SEMESTER 5:

COURSE TITLE: BIOSTATISTICS

Practical/ Lab course (Course code: MNMB 510B-P) Credit: 2

DISCIPLINE SPECIFIC CORE COURSE (MINOR)						
COURSE	*SEMESTER*	*COURSE CODE*	*COURSE TITLE*	*PRACTICAL*		
				Credits	*PRACTICAL*	*INTERNAL/External*
DEGREE COURSE	**B.Sc. 5**	*MN MB-510B-P*	**BIOSTATISTICS**	**1**	**30**	*25(15+10) Marks*
	TOPIC **(30hr)**					

1. Introduction to Biostatistics Tools
   a. Data entry, editing, and basic functions in Excel.
   b. Types of variables: qualitative and quantitative data handling.
2. Descriptive Statistics
   a. Calculation of measures of central tendency: Mean, Median, Mode.
   b. Measures of dispersion: Range, Variance, Standard Deviation, Coefficient of Variation.
   c. Graphical representation: Bar charts, Histograms, Pie charts, Box plots.
3. Correlation and Regression Analysis
   a. Calculation and interpretation of Pearson's and Spearman's correlation.
   b. Simple linear regression: equation fitting and prediction.
   c. Application of regression in microbial growth data.

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 2025-26 UNDER NEP-2020)

SEMESTER 5:

Course Title: BIOSTATISTICS

B. Sc.: MICROBIOLOGY INTERNAL PRACTICAL **MN*MB-510B*P**

Date: **Place:** **Time: ____Hrs -** **Total Marks: 15**

EX-1 1. Introduction to Biostatistics Tools

a. Data entry, editing, and basic functions in Excel.

b. Types of variables: qualitative and quantitative data handling.

2. Descriptive Statistics

a. Calculation of measures of central tendency: Mean, Median, Mode.

b. Measures of dispersion: Range, Variance, Standard Deviation, Coefficient of Variation.

c. Graphical representation: Bar charts, Histograms, Pie charts, Box plots.

3. Correlation and Regression Analysis

a. Calculation and interpretation of Pearson's and Spearman's correlation.

b. Simple linear regression: equation fitting and prediction.

c. Application of regression in microbial growth data.

Ex 2 Spotting 05Marks

Ex 3 Viva voce 02 Marks

Ex 4 Journal 03 Marks

KSKV Kachchh University, Bhuj - Kachchh

(Effective from June 2025-26 UNDER NEP-2020)

SEMESTER 5:

Course Title: BIOSTATISTICS

B. Sc.: MICROBIOLOGY UNIVERSITY PRACTICAL ***MNMB-510B-P***

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

EX-1 1. Introduction to Biostatistics Tools

a. Data entry, editing, and basic functions in Excel.

b. Types of variables: qualitative and quantitative data handling.

2. Descriptive Statistics

a. Calculation of measures of central tendency: Mean, Median, Mode.

b. Measures of dispersion: Range, Variance, Standard Deviation, Coefficient of Variation.

c. Graphical representation: Bar charts, Histograms, Pie charts, Box plots.

3. Correlation and Regression Analysis

a. Calculation and interpretation of Pearson's and Spearman's correlation.

b. Simple linear regression: equation fitting and prediction.

c. Application of regression in microbial growth data.

Ex.2. Spotting 1.5 Marks

Ex 3. Viva voce 02Marks

Ex 4 Journal & 1.5 Marks

DETAILED SYLLABUS OF B.Sc. 3 YEAR FOR DEGREE COURSE IN MICROBIOLOGY

KSKV Kachchh University, Bhuj - Kachchh

(Effective from June 2025-26 UNDER NEP-2020)

SEMESTER 5:

Course Title: BIOPESTICIDE AND BIOCONTROL

Practical/ Lab course (Course code: SECMB 511-P) Credit: 2

DISCIPLINE SPECIFIC CORE COURSE (SEC)						
COURSE	SEMESTER	COURSE CODE	COURSE TITLE	PRACTICAL		
				Credits	Practical	Internal/External
DEGREE COURSE	B.Sc. 5	SECMB - 511-P	BIOPESTICIDE	2	60	50(25+25) Marks
	TOPIC (50hr)					

1. Introduction and Background Study (1–2 sessions)
   Literature review on biopesticides and microbial biocontrol.
   Case studies on commercial biopesticides .
2. Isolation and Identification of Microbial Biocontrol Agents (3–4 sessions)
   Isolation of bacteria or fungi from rhizosphere soil.
   Identification using colony morphology and basic biochemical/gram staining.
   Use of selective media for *Trichoderma*, *Pseudomonas*, *Bacillus* spp.
3. Mass Cultivation and Formulation Techniques (3–4 sessions)
   Preparation of culture media for large-scale production.
   Carrier-based formulation of microbial biopesticides (talc, lignite).
   Quality control parameters (CFU count, moisture, pH).
4. Bioassays and Efficacy Testing (3 sessions)
   In vitro antagonism assay (dual culture method against phytopathogens).
   Testing larvicidal/insecticidal activity (*Bt* strains against mosquito larvae or caterpillars).
   Evaluation of disease suppression in model plants (e.g., tomato seedlings).
5. Report Writing and Presentation (2–3 sessions)
   Compilation of project findings, graphs, and statistical analysis.
   Preparation of a scientific project report.
   Oral/poster presentation of project outcomes.

DETAILED SYLLABUS OF B.Sc. VI YEAR FOR DEGREE COURSE IN MICROBIOLOGY

KSKV Kachchh University, Bhuj - Kachchh

(Effective from June 2025-26 UNDER NEP-2020)

SEMESTER VI:

COURSE TITLE: BIOPROCESS TECHNOLOGY

(Course code: MJMB-601) Credit: 3

DISCIPLINE SPECIFIC CORE COURSE (MAJOR)							
COURSE	*SEMESTER*	*COURSE CODE*	*COURSE TITLE*	*THEORY*			
				Credits	*Lectures*	*External*	*Internal*
DEGREE COURSE	*B.Sc. VI*	*MJ MB-601*	**BIOPROCESS TECHNOLOGY**	**3**	**45**	*0 Marks*	*5 Marks*

UNIT	*TOPIC* (45hrs)	
Course Outcomes (COs):		
UNIT-I	**Introduction to Bioprocess**	**15 Hours**
	1.Concept of fermentation and changing phases in industrial microbiology 2.Stages in development of fermentation process (component parts) 3. Range of fermentation processes 4.Primary screening of amylase, organic acid, antibiotics and amino acid Producers	
UNIT-II	**Fermentation media**	**15 Hours**
	1. Introduction A. Principles of media formulation B. Media ingredients: Water, carbon sources, nitrogen sources, minerals, growth factors, buffers, precursors, inducers, inhibitors, antifoam agents 2. Sterilization of media A. Use of high-pressure steam: Principle, batch and continuous sterilization process B. Use of filtration: Principle, types of filters	
UNIT-III	**Bioreactor Design & Fermentation Economics**	**15 Hours**
	1. Stirred tank Bioreactor A. Essential features of a bioreactor (basic functions) B. Body construction C. Devices for aeration and agitation, pH, temperature, foam and dissolved oxygen D. Bioreactor for specialized purposes: Airlift, Tower & Biocatalytic Reactors 2. Introduction to fermentation economics	

REFERENCE BOOKS:

1. Stanbury P F, Whitaker A, and Hall S J, (1995). Principles of Fermentation Technology, 2nd edn, Pergamon Press, London, UK
2. Waites M J, and Morgam N L,(2002). Industrial Microbiology: An Introduction Blackwell Science
3. Crueger W and Crueger A, (2000), Biotechnology: A Text Book of Industrial Microbiology, 2nd edn, Panima Publishing Corporation, New Delhi, India
4. Trevan M D, Boffey S, Goulding K H, and Standury S, (eds), (1987), Biotechnology: The Biological Principles, Tata McGraw-Hill, New Delhi, India
5. Casida L E, Jr. (1968). Industrial Microbiology, Wiley Eastern Ltd, New Delhi, India

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(Effective from June 2025-26 UNDER NEP-2020)

SEMESTER VI:

COURSE TITLE: BIOPROCESS TECHNOLOGY

Practical/Lab course (Course code: MJ MB-602-P) Credit: 1

DISCIPLINE SPECIFIC CORE COURSE (MAJOR)						
COURSE	*SEMESTER*	*COURSE CODE*	*COURSE TITLE*	*PRACTICAL*		
				Credits	*RACTICAL*	*Internal/External*
DEGREE COURSE	**B.Sc. VI**	*MJMB-602-P*	**BIOPROCESS TECHNOLOGY**	**1**	**30**	*25(15+10) Marks*
UNIT	*TOPIC* **(30hr)**					

1. Separation of amino acids by paper chromatography
2. Separation of amino acids by thin layer chromatography
3. Sterility testing of pharmaceutical product
4. Primary screening of amylase producers
5. Primary screening of organic acid producers
6. Primary screening of antibiotic producers by crowded plate method
7. Determination of OTR under static, sparging and shake flask condition by sulfite oxidation 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 6:

COURSE TITLE: BIOPROCESS TECHNOLOGY

B. Sc.: MICROBIOLOGY INTERNAL PRACTICAL ***MJMB-602-P***

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

Ex. 1. 1. Separation of amino acids by paper chromatography 10 Marks

2. Separation of amino acids by thin layer chromatography

3. Sterility testing of pharmaceutical product

4. Primary screening of amylase producers

5. Primary screening of organic acid producers

6. Primary screening of antibiotic producers by crowded plate method

7. Determination of OTR under static, sparging and shake flask condition by sulfite oxidation method

Ex. 2 Spotting 1.5 Marks

Ex. 3 Viva voce 02 Marks

Ex. 4 Journal 1.5 Marks

KSKV Kachchh University, Bhuj - Kachchh

(Effective from June 2025-26 UNDER NEP-2020)

SEMESTER 6 :

COURSE TITLE: BIOPROCESS TECHNOLOGY

B. Sc.: MICROBIOLOGY UNIVERSITY PRACTICAL ***MJMB 602-P***

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

Ex. 1. 1. Separation of amino acids by paper chromatography 05 Marks

2. Separation of amino acids by thin layer chromatography

3. Sterility testing of pharmaceutical product

4. Primary screening of amylase producers

5. Primary screening of organic acid producers

6. Primary screening of antibiotic producers by crowded plate method

7. Determination of OTR under static, sparging and shake flask condition by sulfite oxidation method

Ex. 2 Spotting 1.5 Marks

Ex. 3 Viva voce 02 Marks

Ex. 4 Journal 1.5 Marks

DETAILED SYLLABUS OF B.Sc. 3 YEAR FOR DEGREE COURSE IN MICROBIOLOGY

KSKV Kachchh University, Bhuj - Kachchh

(Effective from June 2025-26 UNDER NEP-2020)

SEMESTER VI:

COURSE TITLE: VIROLOGY AND MYCOLOGY

(Course code: MJMB-603) Credit: 3

DISCIPLINE SPECIFIC CORE COURSE (MAJOR)							
COURSE	*SEMESTER*	*COURSE CODE*	*COURSE TITLE*	*THEORY*			
				Credits	*Lectures*	*xternal*	*Internal*
DEGREE COURSE	*B.Sc. VI*	*MJMB-603*	VIROLOGY AND MYCOLOGY	3	45	*0 Marks*	*35 Marks*
UNIT	*TOPIC* (45hrs)						

Course Outcomes (COs):

Upon completing this course, students will understand the mechanisms of viral life cycles and multiplication strategies, including attachment, entry, synthesis, assembly, and release. They will be able to distinguish between types of viral infections, including lytic and lysogenic cycles, and understand the relationship between viruses and cancer. Additionally, students will learn about the life cycles of specific viruses, such as bacteriophage lambda and HIV, and sub-viral entities like viroids, prions, and satellites. In mycology, students will understand the general characteristics, classification, isolation, and identification of fungi, as well as their reproduction methods and importance in economy, biotechnology, and pathology.

UNIT-I	**Fundamental Characteristics, Structural Organization and Assay of Viruses**	**15 Hours**
	1. Origin, History and Discovery of Virus. 2. Nomenclature and Classification of Virus: The Baltimore Scheme, The Virosphere by ICTV 3. General Characters and Structure of Virus: Host Range, Viral Size, Nucleic Acid, Capsid, Envelope and Enzyme 4. Viral Symmetry: Helical, Icosahedral and Complex 5. Isolation, Cultivation, and Identification of Viruses: Growing Bacteriophages in the Laboratory, Growing Animal Viruses in the Laboratory (In Living Cell, In Embryonated Egg and In Cell Culture) 6. Culturing, Detecting, and Counting Viruses: Biological Assay (Plaque Assay, fluorescent Focus Assay, Infectious Centre's Assay, Transformation Assay and End-Point Dilution Assay), Physical Assay (Imaging Particles, Haemagglutination, Measurement of viral Enzyme Activity, Serological Virus, Detection of viral nucleic Acid)	

UNIT-II	**Mechanisms of Viral Life Cycle and Multiplication Strategies**	**15 Hours**
	1. Overview of the Viral Life Cycle and Viral Multiplication: Attachment (Adsorption), Entry into the Host, Synthesis Stage, Assembly, Virion Release and One Step Growth Curve. 2. Types of Viral Infections: Infections of Bacterial and Archaeal Cells (Lysis and Lysogeny), Viruses and Cancer. 3. Viral Life Cycles: a. Bacteriophage Lambda: A Temperate Bacteriophage b. Bacteriophage T4: A Virulent Bacteriophage c. Retrovirus: HIV 4. Sub-viral Entities: Viroids, Prions and Satellites	
UNIT-III	**Mycology**	**15 Hours**
	1. General characteristics (Ultrastructure of Fungal cell, Types of Spores, Hyphal Modifications and Types of Fruiting Bodies) 2. Classification of fungi (Classification by Alexopolous and Mims; Classification by Krik et al.,) 3. Isolation and Identification of Fungi (Wet mount (tease mount) method; Adhesive (scotch) tape preparation for fungal spore identification: Lactophenol Cotton Blue (LPCB) Staining) 4. Reproduction in Fungi: General Life Cycle of Fungi, Sexual, Asexual and Parasexuality. 5. Importance of Fungi: Economic and Biotechnological importance of Fungi, Fungi as plant and animal pathogens	

REFERENCE BOOKS:

1. Alexopoulos, C. J., Mims, C. W., & Blackwell, M. (1996). *Introductory mycology* (4th ed.). John Wiley & Sons.
2. Atlas, R. M. (1997). Principles of Microbiology (2nd ed.). Wm. C. Brown Pub., Iowa, USA.
3. Biswas, S. B., & Biswas, A. (1984). An Introduction to Viruses (3rd ed.). Vani Educational Books, New Delhi.
4. Carter, J. B., & Saunders, V. A. (2007). *Virology: Principles and applications*. Wiley.
5. Dimmock, N. J., Easton, A. J., & Leppard, K. N. (2007). *Introduction to modern virology* (6th ed.). Blackwell Publishing.
6. Dube, H. C. (1990). An Introduction to Fungi (2nd ed.). Vikas Publishing House Pvt. Ltd.
7. Madigan, M. T., Martinko, J. M., Bender, K. S., Buckley, D. H., & Stahl, D. A. (2014). *Brock biology of microorganisms* (14th ed.). Pearson.

8. Sharma, O. P. (1989). *Fungi and allied microorganisms*. Tata McGraw-Hill.
9. Tortora, G. J., Funke, B. R., & Case, C. L. (2012). *Microbiology: An introduction* (11th ed.). Pearson.
10. Wagner, E. K., Hewlett, M. J., Bloom, D. C., & Camerini, D. (2007). *Basic virology* (3rd ed.). Wiley-Blackwell.
11. Webster, J. (1980). *Introduction to fungi* (2nd ed.). Cambridge University Press.
12. Willey, J. M., Sherwood, L. M., & Woolverton, C. J. (2016). *Prescott's microbiology* (10th ed.). McGraw-Hill Education.

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SEMESTER VI:
COURSE TITLE: VIROLOGY AND MYCOLOGY
Practical/Lab course (Course code: MJ MB-604-P) Credit: 1

DISCIPLINE SPECIFIC CORE COURSE (MAJOR)						
COURSE	*SEMESTER*	*COURSE CODE*	*COURSE TITLE*	*PRACTICAL*		
				Credits	*RACTICAL*	*Internal/External*
DEGREE COURSE	**B.Sc. VI**	*MJMB-604-P*	VIROLOGY AND MYCOLOGY	**1**	**30**	*25(15+10) Marks*
UNIT	*TOPIC* **(30hr)**					

1. Isolation of bacteriophage from sewage
2. Isolation and cultivation of yeasts
3. Cultivation of and microscopic examination of molds by slide culture technique
4. Cultivation and microscopic examination of molds—Neurospora, Fusarium, Alternaria, Curvularia and Helminthosporium

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 6:

COURSE TITLE: VIROLOGY AND MYCOLOGY

B. Sc.: MICROBIOLOGY INTERNAL PRACTICAL ***MJMB-604-P***

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

Ex. 1. Isolation of bacteriophage from sewage

2.Isolation and cultivation of yeasts

3. Cultivation of and microscopic examination of molds by slide culture technique

4. Cultivation and microscopic examination of molds—Neurospora, Fusarium, Alternaria, Curvularia and Helminthosporium

Ex. 2 Spotting 1.5 Marks

Ex. 3 Viva voce 02 Marks

Ex. 4 Journal 1.5 Marks

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SEMESTER 6 :

COURSE TITLE: VIROLOGY AND MYCOLOGY

B. Sc.: MICROBIOLOGY UNIVERSITY PRACTICAL ***MJMB 604-P***

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

Ex. 1. 1. Isolation of bacteriophage from sewage

2. Isolation and cultivation of yeasts

3. Cultivation of and microscopic examination of molds by slide culture technique

4. Cultivation and microscopic examination of molds—Neurospora, Fusarium, Alternaria, Curvularia and Helminthosporium

Ex. 2 Spotting 1.5 Marks

Ex. 3 Viva voce 02 Marks

Ex. 4 Journal 1.5 Marks

DETAILED SYLLABUS OF B.Sc. 3 YEAR FOR DEGREE COURSE IN MICROBIOLOGY

KSKV Kachchh University, Bhuj - Kachchh

(Effective from June 2025-26 UNDER NEP-2020)

SEMESTER VI:

COURSE TITLE: MEDICAL MICROBIOLOGY

(Course code: MJMB-605) Credit: 3

DISCIPLINE SPECIFIC CORE COURSE (MAJOR)							
COURSE	*SEMESTER*	*COURSE CODE*	*COURSE TITLE*	*THEORY*			
				Credits	*Lectures*	*xternal*	*Internal*
DEGREE COURSE	*B.Sc. VI*	*MJ MB-605*	**MEDICAL MICROBIOLOGY**	**3**	**45**	*0 Marks*	*5 Marks*
UNIT	*TOPIC* **(45hrs)**						
Course Outcomes (COs):							
UNIT-I	**Microbiota of Human Body and Epidemiology**						**15 Hours**
	1. Concept of host- parasite Relationship 2. Microbial pathogenicity A. Overview of bacterial and viral pathogenicity B. Factors affecting the process of infection C. Pathogenicity i. Invasiveness: Role of structures and secretions of bacteria ii. Toxigenicity: Protein and LPS toxins; their properties and mode of action 3. Non-specific host defenses A. First line of (primary) defense: Physical and mechanical defense; role of skin and mucus membrane B. Second line of (secondary) defense: cellular and chemical; defenses 5. Normal microbiota of human body A. Significant role B. Gnotobiotic life and gnotobiosis 6. Epidemiology of infectious disease							

	A. Epidemiological types of infections B. Disease cycle C. Nosocomial infections: sources, transmission and their control	
UNIT-II	**Microbial Diseases of Human Being**	**15 Hours**
	1. Airborne infections: Tuberculosis, influenza 2. Food and waterborne infections: Typhoid fever, food poisoning, hepatitis 3. Contagious diseases: Syphilis, AIDS 4. Arthropod borne diseases: Plague, yellow fever, malaria 5. Zoonoses: Rabies, anthrax	
UNIT-III	**Clinical Microbiology**	**15 Hours**
	1. Specimen: Types of specimen, method of collection, storage and transport 2. Methods used for diagnosis and identification of pathogen A. Microscopy B. Growth and biochemical characteristics C. Rapid identification of blood cells D. Phage typing E. Molecular method F. Pathological changes in blood, body fluids and tissues	

REFERENCE BOOKS:

1. Prescott L, Harley J P, and Klein D A, (2008), Microbiology, 7th edn. Wm C. Brown - McGraw Hill, Dubuque, IA.
2. Baker F J, Silverton R E, Pallister C J, (1998), Baker and Silverton's Introduction to Medical Laboratory Technology, 7th edn, Butterworths- Heinemann, Oxford, UK
3. Tortora G J, Funke B R, Case C L, (2008), Microbiology: An Introduction, 8th edn, Benjamin Cummings

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SEMESTER VI:
COURSE TITLE: MEDICAL MICROBIOLOGY
Practical/Lab course (Course code: MJMB-606-P) Credit: 1

DISCIPLINE SPECIFIC CORE COURSE (MAJOR)						
COURSE	*SEMESTER*	*COURSE CODE*	*COURSE TITLE*	*PRACTICAL*		
				Credits	*PRACTICAL*	*Internal/External*
DEGREE COURSE	**B.Sc. VI**	*MJ MB-606-P*	**MEDICAL MICROBIOLOGY**	**1**	**30**	*25(15+10) Marks*
UNIT	*TOPIC* **(30hr)**					

1. Use of enzyme as analytical tool: Glucose estimation by GOD-POD method
2. Isolation, cultivation and identification of gram-negative bacteria—*Escherichia coli, Enterobacter aerogenes, Proteus vulgaris, Pseudomonas aeruginosa, Salmonella typhi, Salmonella paratyphi A, Salmonella paratyphi B*
3. Study of antibiogram (using multidisk)
4. Physical and chemical analysis of urine
5. Estimation of blood urea by diacetyl monoxime method (DAM)
6. Study of permanent slides
   A. Insect vectors: Female anopheles mosquito, head louse, yick, flea, mite.

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 6:

COURSE TITLE: MEDICAL MICROBIOLOGY

B. Sc.: MICROBIOLOGY INTERNAL PRACTICAL ***MJMB-606-P***

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

Ex.1. Use of enzyme as analytical tool: Glucose estimation by GOD-POD method 10 M

2. Isolation, cultivation and identification of gram-negative bacteria—*Escherichia coli, Enterobacter aerogenes, Proteus vulgaris, Pseudomonas aeruginosa, Salmonella typhi, Salmonella paratyphi A, Salmonella paratyphi B*

3. Study of antibiogram (using multidisk)

4. Physical and chemical analysis of urine

5. Estimation of blood urea by diacetyl monoxime method (DAM)

Ex. 2 Spotting 1.5 Marks

Ex. 3 Viva voce 02 Marks

Ex. 4 Journal 1.5 Marks

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SEMESTER 6 :

COURSE TITLE: MEDICAL MICROBIOLOGY

B. Sc.: MICROBIOLOGY UNIVERSITY PRACTICAL ***MJMB 606-P***

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

Ex.1. Use of enzyme as analytical tool: Glucose estimation by GOD-POD method 5 M

2. Isolation, cultivation and identification of gram-negative bacteria—*Escherichia coli, Enterobacter aerogenes, Proteus vulgaris, Pseudomonas aeruginosa, Salmonella typhi, Salmonella paratyphi A, Salmonella paratyphi B*

3. Study of antibiogram (using multidisk)

4. Physical and chemical analysis of urine

5. Estimation of blood urea by diacetyl monoxime method (DAM)

Ex. 2 Spotting 1.5 Marks

Ex. 3 Viva voce 02 Marks

Ex. 4 Journal 1.5 Marks

DETAILED SYLLABUS OF B.Sc. 3 YEAR FOR DEGREE COURSE IN MICROBIOLOGY

KSKV Kachchh University, Bhuj - Kachchh

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SEMESTER VI:

COURSE TITLE: NUTRITION AND GROWTH OF BACTERIA

(Course code: MNMB-607A) Credit: 3

DISCIPLINE SPECIFIC CORE COURSE (MAJOR)							
COURSE	*SEMESTER*	*COURSE CODE*	*COURSE TITLE*	*THEORY*			
				Credits	*Lectures*	*xternal*	*Internal*
DEGREE COURSE	*B.Sc. VI*	*MNMB-607A*	**NUTRITION AND GROWTH OF BACTERIA**	**3**	**45**	*0 Marks*	*5 Marks*
UNIT	*TOPIC* **(45hrs)**						
Course Outcomes (COs):							
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

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SEMESTER VI:
COURSE TITLE: NUTRITION AND GROWTH OF BACTERIA
Practical/Lab course (Course code: MNMB-608A-P) Credit: 1

DISCIPLINE SPECIFIC CORE COURSE (MAJOR)						
COURSE	*SEMESTER*	*COURSE CODE*	*COURSE TITLE*	*PRACTICAL*		
				Credits	*PRACTICAL*	*Internal/External*
DEGREE COURSE	**B.Sc. VI**	*MNMB-608A-P*	**NUTRITION AND GROWTH OF BACTERIA**	**1**	**30**	*25(15+10) Marks*
UNIT	*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, HgCl2, 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)

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SEMESTER 6:

COURSE TITLE: NUTRITION AND GROWTH OF BACTERIA

B. Sc.: MICROBIOLOGY INTERNAL PRACTICAL ***MNMB-608*A-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 the effect of pH, temperature and osmotic pressure on microorganisms.

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

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

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

Ex. 2 Spotting 1.5 Marks

Ex. 3 Viva voce 02 Marks

Ex. 4 Journal 1.5 Marks

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(Effective from June 2025-26 UNDER NEP-2020)

SEMESTER 6 :

COURSE TITLE: NUTRITION AND GROWTH OF BACTERIA

B. Sc.: MICROBIOLOGY UNIVERSITY PRACTICAL *MNMB 608A-P*

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

Ex.1. Preparation and study of different types of culture media: Mac-Conkeys's agar medium, deoxycholate citrate agar medium, glucose yeast agar medium, thioglycollate 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 the effect of pH, temperature and osmotic pressure on microorganisms.

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

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

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

Ex. 2 Spotting 1.5 Marks

Ex. 3 Viva voce 02 Marks

Ex. 4 Journal 1.5 Marks

DETAILED SYLLABUS OF B.Sc. 3 YEAR FOR DEGREE COURSE IN MICROBIOLOGY

KSKV Kachchh University, Bhuj - Kachchh

(Effective from June 2025-26 UNDER NEP-2020)

SEMESTER VI:

COURSE TITLE: ENVIRONMENTAL MICROBIOLOGY

(Course code: MNMB-607B) Credit: 3

DISCIPLINE SPECIFIC CORE COURSE (MAJOR)							
COURSE	*SEMESTER*	*COURSE CODE*	*COURSE TITLE*	*THEORY*			
				Credits	*Lectures*	*xternal*	*Internal*
DEGREE COURSE	*B.Sc. VI*	*MNMB-607B*	**ENVIRONMENTAL MICROBIOLOGY**	**3**	**45**	*0 Marks*	*5 Marks*
UNIT	*TOPIC* **(45hrs)**						
Course Outcomes (COs):							
UNIT-I	**Principles of Waste Treatment**						**15 Hours**
	Biochemistry and Microbiology of inorganic phosphorus and nitrogen removal. Suspended growth technologies: Activated sludge, oxidation ditches, waste stabilization ponds. Fixed film technologies: Trickling filters, rotating biological contactors, fluidized bed and submerged aerated filters						
UNIT-II	**Techniques of Waste Treatment**						**15 Hours**
	1.Toxicity testing in waste water treatment plants using microorganisms. 2.Anaerobic digestion: microbiological and biochemical fundamentals, factors influencing anaerobic digestion. 3.Anaerobic waste water treatment systems: RBC, UASB, anaerobic filters. Merits and demerits of anaerobic treatment of waste.						
UNIT-III							**15 Hours**
	Bioremediation MEOR Bioaugmentation Biostimulaion Phytoremediation Remediation of Oil Spills						

REFERENCE BOOKS:

1. Microbiology, Pelczar, M.J.chan, E.C.S., Krig, N.R., McGrow – Hill Book Co.
2. Biotechnology-Rehm and Reid.
3. Waste water microbiology by G. Bitton
4. Biodegradation and bioremediation byM.Alexander
5. Waste water treatment for pollution control, 2nd edition. Arceivala
6. Environmental Biotechnology by H. Jordening and JosefWinter .
7. Comprehensive Biotechnology Vol-4, MurrayMoo Young.

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SEMESTER VI:

COURSE TITLE: ENVIRONMENTAL MICROBIOLOGY

Practical/Lab course (Course code: MNMB-608B-P) Credit: 1

DISCIPLINE SPECIFIC CORE COURSE (MAJOR)						
COURSE	*SEMESTER*	*COURSE CODE*	*COURSE TITLE*	*PRACTICAL*		
				Credits	*PRACTICAL*	*Internal/External*
DEGREE COURSE	**B.Sc. VI**	*MNMB-608B-P*	**ENVIRONMENTAL MICROBIOLOGY**	**1**	**30**	***25(15+10) Marks***
UNIT	*TOPIC* **(30hr)**					

1. Gravimetric Analysis of Waste water (TS,TDS,TSS)
2. Estimation of acidity and Alkalinity of wastewater
3. Estimation of Hardness
4. Estimation of Conductivity and pH of water sample
5. Estimation of sulphate and phosphate

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. APHA, 2012
5. Trivedi and Gohil,

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SEMESTER 6:

COURSE TITLE: ENVIRONMENTAL MICROBIOLOGY

B. Sc.: MICROBIOLOGY INTERNAL PRACTICAL ***MNMB-608*B-P**

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

Ex.1. Gravimetric Analysis of Waste water (TS,TDS,TSS)

2. Estimation of acidity and Alkalinity of wastewater
3. Estimation of Hardness
4. Estimation of Conductivity and pH of water sample
5. Estimation of sulphate and phosphate

Ex. 2 Spotting 1.5 Marks

Ex. 3 Viva voce 02 Marks

Ex. 4 Journal 1.5 Marks

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SEMESTER 6 :

COURSE TITLE: ENVIRONMENTAL MICROBIOLOGY

B. Sc.: MICROBIOLOGY UNIVERSITY PRACTICAL ***MNMB 608B-P***

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

Ex.1. Gravimetric Analysis of Waste water (TS,TDS,TSS)

1. Estimation of acidity and Alkalinity of wastewater
2. Estimation of Hardness
3. Estimation of Conductivity and pH of water sample
4. Estimation of sulphate and phosphate

Ex. 2 Spotting 1.5 Marks

Ex. 3 Viva voce 02 Marks

Ex. 4 Journal 1.5 Marks

DETAILED SYLLABUS OF B.Sc. 3 YEAR FOR DEGREE COURSE IN MICROBIOLOGY

KSKV Kachchh University, Bhuj - Kachchh

(Effective from June 2025-26 UNDER NEP-2020)

SEMESTER 6:

Course Title: INTERNSHIP

Practical/ Lab course (Course code:INTMB 609) Credit: 4

DISCIPLINE SPECIFIC CORE COURSE (INTERNSHIP)						
COURSE	*SEMESTER*	*OURSE CODE*	*OURSE TITLE*	*PRACTICAL*		
				Credits	*Practical*	*Internal /External*
DEGREE COURSE	**B.Sc. VI**	**INTMB 609**	**INTERNSHIP**	**4**		*50(25+25) Marks*
	TOPIC **(50hr)**					

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