NISHITHA DEGREE COLLEGE

(AUTONOMOUS)

Nizamabad–Telangana - 503003

DEPARTMENT OF MICROBIOLOGY

B.Sc (MBB)

I & II-Semester

SYLLABUS (CBCS)

(w.e.f. 2025-26 onwards)

NISHITHA DEGREE COLLEGE (AUTONOMOUS), NIZAMABAD

Affiliated to Telangana University, Accredited with 'A' Grade by NAAC

UG – B.SC MICROBIOLOGY SYLLABUS – 2025-26

Proposed CBCS structure for Undergraduate (B.Sc) program.

Courses		Papers	Credits	Credits for each paper / Semester					
				I	II	III	IV	V	VI
B.Sc	Major-1	6	30	5	5	5	5	5	5
	Major-2	6	30	5	5	5	5	5	5
	Minor-1	4	20	5	5	5	5	-	-
English		4	20	5	5	5	5	-	-
Sec. language		4	20	5	5	5	5	-	-
MDC		1	4	-	-	-	-	4	-
SEC 1		2	4	-	-	-	-	2	-
SEC 2								2	-
SEC 3								-	2
SEC 4		2	4	-	-	-	-	-	2
VAC 1		2	6	-	-	-	-	3	-
VAC 2								-	3
Internship/Project		1	4	-	-	-	-	-	4
Total credits in each semester		-	-	25	25	25	25	21	21
Total credits in UG			142						
Credits under Non-CGPA (Community engagement and service)		NSS/ NCC/Sports/ Extra curricular	Upto 6 (2 in each year)						
		IKS	Upto 4 (2 in each, after I and II years)						

Students will pursue two Majors and one Minor, collectively referred to as Discipline Specific Core (DSC). Both Major and Minor courses will remain integrated upto the fourth semester, after which students will have option to drop one Minor course in both the fifth and sixth semesters. The syllabus and credits for Major and Minor courses will remain consistent upto the fourth semester, with the Major continuing for Fifth and Sixth Semester.

MDC - Multi-Disciplinary Course (Proposed paper across other Disciplines)

SEC- Skill Enhancement Course

VAC - Value Added Course

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UG – B.SC MICROBIOLOGY SYLLABUS – 2025-26

Code	Course Title	Course Type	HPW	Credits
FIRST YEAR- SEMESTER-I				
	English			5
	Second Language			5
Major - 1/ Minor-1	**Introductory Microbiology**	DSC-1A	4+1	5
	Major/Minor - Optional paper			5
	Major/Minor - Optional paper			5
	TOTAL Semester I			**25**
SEMESTER-II				
	English			5
	Second Language			5
Major-1 / Minor-1	**Biomolecules**	DSC-1B	4+1	5
	Major/Minor - Optional paper			5
	Major/Minor - Optional paper			5
	TOTAL Semester II			**25**
SECOND YEAR - SEMESTER-III				
	English			5
	Second Language			5
Major-1 / Minor-1	**Applied Microbiology**	DSC-1C	4+1	5
	Major/Minor - Optional paper			5
	Major/Minor - Optional paper			5
	TOTAL Semester III			**25**
SEMESTER- IV				
	English			5
	Second Language			5
Major -1/ Minor-1	**Immunobiology and Clinical Microbiology**	DSC-1D	4+1	5
	Major/Minor - Optional paper			5
	Major/Minor - Optional paper			5
	TOTAL Semester – IV			**25**

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UG – B.SC MICROBIOLOGY SYLLABUS – 2025-26

THIRD YEAR-SEMESTER- V				
	Multi-Disciplinary Course (Paper proposed across other disciplines)	MDC	4	4
	Skill Enhancement Course 1	SEC- 1*	2	2
	Skill Enhancement Course 2	SEC- 2*	2	2
	Value Added Course	VAC-1*	3	3
Major -1	**Molecular Biology & Microbial Genetics**		4+1	5
	Optional paper (Major)			5
	TOTAL Semester V			**21**
SEMESTER-VI				
	Skill Enhancement Course 3	SEC - 3*	2	2
	Skill Enhancement Course 4 **Quality Control and Accreditation** **or** **Bioinformatics and *In silico* drug discovery**	SEC - 4	2	2
	Value added Course	VAC-2*	3	3
Elective Paper for **Major-1**	**1A. Industrial Microbiology** **or** **1B. Pharmaceutical Microbiology** **or** **1C. Microbial Omics**	DSE-1A or DSE-1B or DSE-1C	4+1	5
	Optional paper (Major)			5
	PROJECT WORK / Internship		4	4
	TOTAL Semester VI			**21**
	Program Total			**142**

*Paper and curriculum details will be provided by TGCHE

- **SEC-4. Subject specific two papers are given (Anyone paper can be selected)**
- **MDC is proposed across other disciplines**
- **Elective papers are given only in VI semester**

PROGRAM OUTCOMES

The B.Sc. Microbiology program syllabus is designed and practiced to benefit the students for their higher education and technical skills. Practical experiments in the syllabus are designed according to the industrial task force requirement in pharma and biotech sectors. In addition, these practical's with real time samples will train the students to work on different innovative projects. This will motivate the students to participate in conferences and understand about filing patents for novel process. Latest subject oriented theoretical and practical knowledge is imparted to the students, which will benefit them in their future endeavors.

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PROGRAM OUTCOMES (PO)

1. Students can gain knowledge in laboratory techniques such as culturing , staining, microscopy and sterilization
2. Students can get ability in analyzing in food, water , soil and clinical samples for microbial quality and safety
3. Students can builds problem solving skills for real life issues like antibiotic resistance, pollution, food spoilage and healthcare
4. Students can work in – Hospitals , Diagnostic labs , pharmaceutical industries and food and dairy industry.
5. Students have scope in Research Institutes (M.Sc. Ph.D) ,Teaching fields and civil services examinations
6. Students also acquire knowledge in Public Health and Epidemiology like monitoring and preventing infectious disease outbreak

PROGRAM SPECIFIC OUTCOMES (PSO)

PsO1: Students will develop effective communication, presentation and scientific writing skills for academic and professional growth.

PsO2: Students will acquire the ability to design and present research project applicable to industries, research laboratories, diagnostic centres.

Ps03: Students will gain foundational knowledge and hands – on training in big data handling, statistical analysis and bioinformatics tools relavant to microbiology.

PsO4: Students will understand the applications of microorganisms in healthcare, agriculture, food, environment and industrial biotechnology sectors .

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DEPARTMENT OF MICROBIOLOGY
Discipline Specific Core (DSC)

B.Sc. Microbiology program under choice based credit system (CBCS)
With effect from 2025-26
Syllabus for B.Sc. Microbiology (MAJOR/MINOR)
B.Sc. I year: I-Semester

Code: DSC-1A **4HPW-Credits-4**

Title: INTRODUCTORY MICROBIOLOGY (Paper-I)

Course outcomes:CO1: Students will learn fundamentals and history of microbiology.

CO2: Students will learn structure and classification of microorganisms.

CO3: Students will study microbial diversity and growth patterns.

CO4:Students will learn microbial control strategies and culturing of pure strains.

Unit-1: Introduction to Microbiology

History of Microbiology: Contribution of Antony Van Leewenhock, Louis Pasteur and Robert Koch, Edward Jenner. Information about Microorganisms (sukshmajeevanu) in Vedas.

Principles of Microscopy Bright field, Dark field, Phase-contrast, Fluorescent and Electron microscopy (SEM and TEM). Principles and types of stains-simple stain, Differential stain- Gram staining and Acid Fast. Negative staining. Structural stain-spore, capsule, flagella. Bacterial motility -Hanging drop method.

Unit-2: Microorganisms: Classification & Structural features

Introduction to Classification of living organisms. General characteristics and classification of viruses. Morphology and structure of TMV and HIV. Structure and multiplication of lambda bacteriophage. Prokaryotes: Ultra structure of eubacteria-Cellular components(capsid, cellwall, cell membrane,mesosomes,plasmid,pilli, flagella, genetic material, ribosomes, cytoplasm, granular inclusion, gas vacuole). Differentiation of prokaryotes and eukaryotes. Morphological characteristics and features of typical eubacteria, Chlamydia, Rickettsiae, Mycoplasma, Archaebacteria, Cyanobacteria, Algae, Fungi, actinomycetes.

Unit-3: Microbial Diversity, Nutrition & Growth

Basic concept of Biodiversity and Conservation. National Biodiversity authority (NBA). Understanding microbial diversity in the genomics era. Introduction to Metagenomics.

Microbial Nutrition-Nutritional groups of microorganisms-Autotrophs, Heterotrophs, Mixotrophs. Components and types of bacterial growth media simple and complex media. Microbial growth-Different Phases of Growth in Batch culture.

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Factors Influencing microbial growth. Synchronous, Continuous, Biphasic Growth. Methods for measuring microbial growth Direct Microscopic, Viable count, Turbidometry, Biomass.

Unit-4: Sterilization & Pure Culture Techniques

Sterilization and disinfection techniques Physical methods- Autoclave, Hot air oven, Laminar air flow, Filter sterilization. Radiation methods – U.V rays, Gamma rays, Ultrasonic methods. Chemical methods-Alcohols, Aldehydes, Phenol, Halogens and Hypo chlorides.

Use of Biological safety cabinets, types. Primary containment for Biohazards. Biosafety levels. Isolation of pure culture; Techniques- Enrichment culturing, Dilution plating, pour plate method, streak plate, spread plate, Micromanipulator.

Preservation of Microbial cultures Sub culturing, overlaying cultures with minerals oils, lyophilization, sand cultures and storage at low temperature.

References:

1. Michael J. Pelczar, Jr. E. C.S. Chan, Noel R. Krieg Microbiology Tata MeGraw-Hill Publisher.

2. Prescott, L.M., Harley, J.P. and Klein, D.A. (2002) Microbiology: Food and Industrial Microbiology. 5th Edition, McGraw-Hill, Boston, 978-981.

3. Madigan, M.T., Martinko, J.M. and Parker, J. (1997) Brock Biology of Microorganisms. 8th Ecition, Prentice Hall International, Inc., New York.

4. A. Mani, A.M.Selvaraj, N. Arumugam L.M. Narayanan. Microbiology-General and Applied. 2017. Saras publications.

5. Chand Pasha and Hameeda Bee (2024) Text Book of General Microbiology. Professional Books Publishers, Hyderabad

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Introductory Microbiology

PRACTICALS **2HPW-Credits-1**

1. Handling and calibration of light microscope.
2. Simple and differential staining (Gram staining)
3. Demonstration of spore staining
4. Isolation of bacteriophage from sewage sample.
5. Preparation of media for culturing autotrophic and heterotrophic microorganisms-algal medium, mineral salts medium, nutrient agar medium. Mac Conkey agar and blood agar.
6. Sterilization techniques: Autoclave, Hot air oven and filtration.
7. Enumeration of bacterial numbers by serial dilution and plating (viable count and calculation of CFU and conversion to log value)
8. Isolation of bacteria and fungi from soil
9. Pure culture technique streak, spread and pour plate method
10. Isolation of halophilic bacteria.
11. Microscopic observation of cyanobacteria (Nostoc, Spirulina), algae and fangi (Saccharomyces, Rhizopos, Aspergillus, Penicillium).
12. Winogradsky's column to demonstrate microbial diversity
13. Preservation of microbial cultures Slan, Stab, Sand cultures, mineral oil overlay and glycerol stocks
14 . Turbidemetry measurement of bacterial growth and plotting growth curve.

References:

1. Alfred Brown and Heidi Smith, 2017, Bensons Microbiological application: A laboratory manual in General Microbiology, Indian Edition, Me. Graw Hill (13)

2. Chand Pasha and Bhima (2024) Laboratory Experiments in Microbiology. ISBN no 978-81-969070-5-1, Professional Books Publishers, Hyderabad

3. Laboratory manual of Microbiology and Bictechnology by K.R. Aneja. 2014

4.Practical Microbiology, R.C. Dubey and D.K. Maheshwari, 2012, Chand Publications 5. Gopal Reddy.M., Reddy.M.N., Sai Gopal, DVR and Mallaiah K.V. Laboratory Experiments in Microbiology.

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DEPARTMENT OF MICROBIOLOGY

Discipline Specific Core (DSC)

B.Sc. Microbiology program under choice based credit system(CBCS)

With effect from 2025-26

Syllabus for B.Sc. Microbiology (MAJOR/MINOR)

B.Sc. I Year: II-Semester

Code: DSC-IB **4HPW-Credits-4**

Title: BIOMOLECULES (Paper-II)

Course outcomes:CO1: Students will learn microbial diversity and interactions

CO2: Students will gain knowledge on microbial classification and taxonomic updates

CO3: Students will comprehend the structure and features of biomolecules

CO4: Students will be exposed to basics of enzyme kinetics and regulations

Unit-1:Biological Macromolecules

Carbohydrates: Monosaccharides: aldoses and ketoses, epimers, mutarotation and anomers of glucose, Sugar derivatives. Glucosamine, Galactosamine, Muramic acid, N-acetyIneuraminic acid. Disaccharides, Polysaccharides.

Amino acids and Proteins: Types, Structure and functions. Classification of enzymes. Active site and activation energy. Lock and key hypothesis, induced fit hypothesis.

Lipids: Introduction to storage and structural lipids. Storage lipids: triacylglycerols, building blocks, fatty acids structure and properties, essential fatty acid. Saponification. Structural lipids. Phosphoglycerides-building blocks.

Unit-2: Basics to Molecular Biology

Structure of DNA-Watson and Crick model. Types of DNA, RNA.

DNA and RNA as genetic material. Extra chromosomal genetic elements-Plasmids and Transposons

Replication of DNA- Sem: conservative mechanism. Concept of gene.

Transcription and translation of prokaryotes. Introduction to operon concept-Lac operon model.

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Unit-3: Biomolecular Chemistry

Concept of aerobic respiration, anaerobic respiration. Respiration Glycolysis, HMP Pathway, ED Pathway, TCA Cycle. Electron transport chain (ETC): components of respiratory chain, comparison of mitochondrial and bacterial ETC, Oxidative and substrate level phosphorylation. Fermentation-Common microbial fermentations

Unit-4: Biochemical Techniques

Buffers- Types of buffers and their use in biological reactions, Hydrogen ion concentration in biological fluids, measurement of pH. Principle and applications of Colorimetry and Spectrophotometry. Chromatographic techniques: Thin layer and coloamn. Electrophoresis. Agarose gel zlectrophoresis and PAGE (Poly acrylamide gel electrophoresis).

References:1. PelczarJr.M.J., Chan. E.C., Sand Kreig.N.R (2006). "Microbiology"-5th Edition Me. Graw Hill Inc. New York,

2. Brown J.W. (2015) Principles of Microbial Diversity, ASM Press

3. Epstein S.S. (2009) Uncultivated microorganisms, Springer-Verlag Publishers

4. Madigan M.T., Bender K.S., Buckley D. H., Sattley W.M. and Stahl D.A. (2017) Brock Biology of Microorganisms, 15th Edition (Global Edn.) Pearson Education.

5. Principles of Biochemistry, by A.H. Lehninger

6. Berg, Tymoczko and Stryer, Textbook of Biochemistry. Fifth Edition.

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BIOMOLECULES

PRACTICALS **2HPW-Credits-1**

1. Qualitative analysis of carbohydrates

2. Study of protein structures with the help of models

3. Determination f acid value of fatty acids

4. Enzyme assay of Amylase and Protease

5. Handling of pH meter

6. Demonstration for Colorimetry

7. Demonstration for Chromatographic techniques and applications

8. Demonstration of agarose gel electrophoresis

References:

1. Chand Pasha, Bhima (2024) Laboratory Experiments in Microbiology. ISBN no 978-81-969070-5-

1, Professional Books Publishers, Hyderabad

2. Aneja, K. R. (2001). Experiments in Microbiology, Plant pathology. Tissue culture and Mushroom Production Technology, 3rd Edition, New Age International (P) Ltd., New Delhi.

3. Dubey, R.C.and Maheswari, D.K. (2002) Practical Microbiology, S. Chand &Co.. New Delhi

4. Kannan, N. (2003). Hand Book of Laboratory Culture Media, Reagents, Stains and Buffers. Anima Publishing Co., New Delhi.

5. Gopal Reddy, M., Reddy, M.N., Saigopal, DVR and Mallainh, K.V. (2007) Laboratory Experiments in Microbiology, 2nd edition. Himalaya Publishing House, Mumbai.

6. Microbial diversity with practicals. A. Madhuri and Bi Susmitha DLPD.2021

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Recognized u/s 2(f) and 12B by UGC, ISO 9001:2015 Certified Institution
B.Sc (MBB) I-Year I-Semester, I-INTERNAL ASSESSMENT

Name of the Student: Hall Ticket No:

Subject:MICROBIOLOGY Max Marks: 30 Marks

Section	I	II	III	Total
Marks				

I. MULTIPLE CHOICE QUESTIONS **10 X 1/2=5 M**

1.
2.
3.
4.
5.
6.
7.
8.
9.
10.

II. FILL IN THE BLANKS **10 X 1/2=5 M .**

1.
2.
3.
4.
5.
6.
7.
8.
9.
10.

III. ANSWER THE FOLLOWING QUESTIONS **5 X 2=10M**

1. **UNIT – I (a) or (b)**

2. **Unit – II (a) or (b)**

IV. ASSISGNMENT **5 Marks**

V. SEMINAR **5 Marks**

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NISHITHA DEGREE COLLEGE, NIZAMABAD

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PATTERN OF QUESTION PAPER FOR B.SC EXAMINATION ONLY

B.Sc. (MBB) ALL Semesters (Regular/Backlog) Examinations

Time : 3 Hours **Max Marks:70**

I. Answer any SIX of the following questions **(6x5=30 Marks)**

1. From Unit-I
2. From Unit-I
3. From Unit-II
4. From Unit-II
5. From Unit-III
6. From Unit-III
7. From Unit-IV
8. From Unit-IV

II. Answer the following questions **(4x10=40 Marks)**

9. (a) Unit I

   OR

   (b) Unit I

10. (a) Unit II

    OR

    (b) Unit II

11. (a) Unit III

    OR

    (b) Unit III

12. (a) Unit IV

    OR

    (b) Unit IV

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PRACTICAL QUESTION PAPER PATTERN FOR B.Sc EXAMINATIONS ONLY

B.Sc. MICROBIOLOGY ALL Semesters (Regular/Backlog) Examinations

Time : 3 Hours **Max Marks:50**

I. MAJOR EXPERIMENT	(1x20=20M)
II . MINOR EXPERIMENT	(1x10=10M)
III. SPOTTERS	(5x2=10M)
IV. VIVA	(5M)
V. RECORD	(5M)

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Department of Microbiology B. Sc. Microbiology Panel list of Examiners for 2025-26				
Sr. No.	Name	Designation	Mobile No.	Email
1	Dr. P.Muthenna	Associate Professor, Dept of Microbiology GGC(A), Nizamabad	9959029563	muthennanin@gmail.com
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5	Shaik Akbar Pasha	Asst Professor Dep of Microbiology, GDC (A) Banswada	8555991592	Pryp88@gmail.com
6	Dr. Sujatha	Associate Professor Department of Microbiology Kakatiya University	9885996913	Sujathaedla_1973@kakatiya.ac.in
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