# UNIVERSITY OF MUMBAI

## Revised Syllabus for S.Y.B.Sc.
## Program: B.Sc.
## Course: MICROBIOLOGY (USMB)

(Choice Based Credit System with effect from the Academic year 2017-18)

# Preamble

Choice Based Credit System (CBCS) was introduced by our University from the academic year 2016-2017. Objective is to create a curriculum where students are given a chance to learn course of their choice from other subjects, giving them opportunity to choose from a bouquet of Science Courses relevant to their curiosity and future career goal.

The process was initiated with restructuring of FYBSc syllabus according to this CBCS pattern and its implementation in year 2016-2017. As a continuation of this theme, the restructured syllabus of SYBSc is prepared as per the CBCS pattern. As a part of this theme, in SYBSc Paper III in all subjects is available to any BSc student irrespective of their subject combination. So students of any subject interested in Microbiology can opt for Paper III of Microbiology course. Likewise Microbiology Students can opt for Paper III of any subject available in their College. Since this paper is open to all students, 2 options are created to provide diversity of applied topics and choice for student and students can select any one option (provided it is offered by their college) relevant to their curiosity and future career goal.

# S.Y.B.Sc Microbiology Syllabus (General Outline)
# Revised for Choice Based Credit System
# To be implemented from the Academic year 2017-18
# Semester III

| | SEMESTER III | | |
|---|---|---|---|
| **Course Code** | **Title** | **Credits** | Lectures / week |
| **USMB-301 Theory** | **Biomolecules and Microbial taxonomy** | 2 Credits (45 lectures) | 3 |
| **Unit-I** | Estimation of Biomolecules | 15 lectures. | 1 |
| **Unit-II** | Nucleic acid structure and chemistry | 15 lectures. | 1 |
| **Unit-III** | Microbial Taxonomy | 15 lectures. | 1 |
| | | | |
| **USMB-302 Theory** | **Environmental Microbiology** | 2 Credits (45 lectures) | 3 |
| **Unit-I** | Air Microbiology | 15 lectures. | 1 |
| **Unit-II** | Fresh Water & Sewage Microbiology | 15 lectures. | 1 |
| **Unit-III** | Soil and Geo Microbiology | 15 lectures. | 1 |
| | | | |
| **USMB-303 Option A Theory** | **Introduction to Clinical Microbiology** | 2 Credits (45 lectures) | 3 |
| **Unit-I** | Basic Microbiology | 15 lectures. | 1 |
| **Unit-II** | Common infectious diseases, Epidemiology and public health awareness | 15 lectures. | 1 |
| **Unit-III** | Control of Microorganisms & Safety in Clinical Microbiology | 15 lectures. | 1 |
| | **OR** | | |
| **USMB-303 Option B** | **Basic and Advanced Microbiology** | 2 Credits (45 lectures) | 3 |
| **Unit-I** | Basics of Microbiology | 15 lectures. | 1 |
| **Unit-II** | Physical and chemical agents for Microbial Control | 15 lectures. | 1 |
| **Unit-III** | Basic r DNA technology and Bioinformatics | 15 lectures. | 1 |
| | | | |
| **USMBP-3** | PRACTICALS | 3 Credits | 9 |
| SECTION-1 | **Biomolecules and Microbial taxonomy** (Practicals Based On Unit-I,II & III Of USMB-301 | 1 Credit (45 lectures) | 3 |
| SECTION-2 | **Environmental Microbiology** (Practicals Based On Unit-I,II & III Of USMB-302 | 1 Credit (45 lectures) | 3 |
| SECTION-3 Any One Option | Option A: **Introduction to Clinical Microbiology** (Practicals Based On Unit-I,II & III Of USMB-303 Option A) | 1 Credit (45 lectures) | 3 |
| | Option B: **Basic and Advanced Microbiology** (Practicals Based On Unit-I,II & III Of USMB-303 Option B) | 1 Credit (45 lectures) | 3 |

**S.Y.B.Sc Microbiology Syllabus (General Outline)**
**Revised for Choice Based Credit System**
**To be implemented from the Academic year 2017-18**
**Semester IV**

| | SEMESTER IV | | |
|---|---|---|---|
| **Course Code** | **Title** | **Credits** | **Lectures / week** |
| USMB-401 Theory | **Metabolism & Basic Analytical Techniques** | 2 Credits (45 Lectures) | 3 |
| Unit-I | Introduction To Metabolism & Bioenergetics | 15 lectures. | 1 |
| Unit-II | Enzyme Kinetics | 15 lectures. | 1 |
| Unit-III | Analytical techniques | 15 lectures. | 1 |
| | | | |
| USMB-402 Theory | **Applied Microbiology** | 2 Credits (45 Lectures) | 3 |
| Unit-I | Host defence and public health (Epidemiology of infectious diseases) | 15 lectures. | 1 |
| Unit-II | Food Microbiology | 15 lectures. | 1 |
| Unit-III | Dairy Microbiology | 15 lectures. | 1 |
| | | | |
| USMB-403 Option A Theory | **Fermented Foods, Food Sanitation and Microbial Ecology** | 2 Credits (45 lectures) | 3 |
| Unit-I | Fermented Foods | 15 lectures. | 1 |
| Unit-II | Food Sanitation | 15 lectures. | 1 |
| Unit-III | Microbial evolution and ecology | 15 lectures. | 1 |
| | | | |
| USMB-403 Option B Theory | **Advances & Applications Of Microbiology and Soft Skills** | 2 Credits (45 lectures) | 3 |
| Unit-I | Nanobiotechnology, Biofilms and biosensors with applications | 15 lectures. | 1 |
| Unit-II | Scientific writing, research methodology and Biostatistics | 15 lectures. | 1 |
| Unit-III | Biofertiliser, Biopesticide , Bioremediation | 15 lectures. | 1 |
| | | | |
| USMBP-4 | PRACTICALS | 3 Credits | 9 |
| SECTION-1 | **Metabolism & Basic Analytical Techniques** (Practicals Based On Unit-I,II & III Of USMB-401 | 1 Credit (45 lectures) | 3 |
| SECTION-2 | **Applied Microbiology** (Practicals Based On Unit-I,II & III Of USMB-402 | 1 Credit (45 Lectures) | 3 |
| SECTION-3 Any One Option | Option A **Fermented Foods, Food Sanitation and Microbial Ecology** (Practicals Based On Unit-I,II & III Of USMB-403 Option A) | 1 Credit (45 Lectures) | 3 |
| | Option B **Advances & Applications Of Microbiology and Soft Skills** (Practicals Based On Unit-I,II & III Of USMB-403 Option B) | 1 Credit (45 Lectures) | 3 |

| USMBP-3 | PRACTICALS | 2 Credits | Notional Periods |
|---|---|---|---|
| **Section-1** | **Biomolecules and Microbial taxonomy**<br>(Practicals Based On Unit-I,II & III Of USMB-301 | | |
| **Unit-I** | 1. Estimation of total sugar by Anthrone method(Demo)<br>2. Estimation of reducing sugar by DNSA method<br>3. Estimation of reducing method by Felhing's method<br>4. Estimation of protein Biuret method (indirect and direct)<br>5. Extraction of lipid by Soxhlet method (Demonstration) | **1 Credit (45 lectures)** | Self Study (45) |
| **Unit-II** | 6. Isolation and detection of DNA from onion / E.coli<br>7. Estimation of DNA by DPA method<br>8. Estimation of RNA by Orcinol method | | |
| **Unit-III** | 9. Identification of bacteria | | |
| **Section-2** | **Environmental Microbiology**<br>(Practicals Based On Unit-I,II & III Of USMB-302 | | |
| **Unit-I** | 1. Enumeration of microorganisms in air and study of its load after fumigation<br>2. Study of air microflora and determination of sedimentation rate | **1 Credit (45 lectures)** | Self Study (45) |
| **Unit-II** | 3. Routine analysis of water:<br>a. Standard Plate Count<br>b. Detection of Coliforms in water: Presumptive Test, Confirmed Test and Completed Test<br>c. Rapid Detection of E.coli by MUG Technique (Demonstration)<br>4. Waste water analysis:<br>a. Study of microbial flora in raw and treated sewage<br>b. Determination of total solids in wastewater<br>c. Determination of BOD and COD of wastewater | | |
| **Unit-III** | 5. Total viable count of soil microflora<br>6. Isolation of bacteria, Actinomycetes and fungi from soil<br>7. Enrichment and isolation of Nitrosifiers, Nitrifiers, Cellulose degraders, Sulphate reducers and Phosphate solubilisers from soil<br>8. Winogradskys column<br>9. Visit to a sewage treatment plant or water purification plant | | |
| **Section-3 Option A** | Option A: **Introduction to Clinical Microbiology**<br>(Practicals Based On Unit-I,II & III Of USMB-303 Option A) | | |
| **Unit-I** | 1 Study of different parts of a compound Microscope.<br>2 Monochrome staining of bacterial smear. | **1 Credit** | Self Study |

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| | 3 Gram staining of bacterial smear.<br>4 To study the growth of yeast on the Sabouraud agar<br>To study the growth of lactose fermentor and non lactose fermentors on the MacConkey's agar | **(45 lectures)** | (45) |
| **Unit-II** | *5* Isolation of *Pseudomonas, Escherichia coli and S. typhi*<br>6 Permanant slides of *Entamoeba histolytica*<br>7 Assignment on: i. Normal flora of - skin/ respiratory system/ nervous system / digestive system, ii. Immunization programmes in India (role of CDC, WHO, ICMR, NICD, NAARI) | | |
| **Unit-III** | 8 Determination of MIC of a chemical disinfectant<br>9 AST-Kirby method<br>10 Effect of UV | | |

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|---|---|---|---|
| **USMBP-4** | **PRACTICALS** | **2 Credits** | |
| **SECTION-1** | **Metabolism & Basic Analytical Techniques**<br>(Practicals Based On Unit-I,II & III Of USMB-401 | **1 Credit (45 lectures)** | Self Study (45) |
| **Unit-I** | 1. Problems on bioenergetics to calculate the Keq.; Gibbs energy , enthalpy, etc. . | | |
| **Unit-II** | 2. Isolation of amylase, protease, lipase producers.<br>3. Extracellular production of invertase from yeast.<br>4. Effect of pH, Temp, substrate and enzyme concentration on activity of invertase.<br>5. Determination of Km and Vmax of an enzyme. | | |
| **Unit-III** | 6. Separation and identification of amino acids and sugars by ascending paper chromatography.<br>7. Sizing Yeast cells<br>8. Electrophoresis & centrifuge machine [D] | | |
| **Section-2** | **Applied Microbiology**<br>(Practicals Based On Unit-I,II & III Of USMB-402 | **1 Credit (45 lectures)** | Self Study (45) |
| **Unit-I** | 1. Differential staining:Blood staning<br>2. Isolation of organism from fomites.<br>3. Pyocin typing<br>4. Phagocytosis (demonstration)<br>5. Selective isolation of *Staphylococcus & Pseudomonas sp* | | |
| **Unit-II** | 6. Isolation of food spoilage agent:<br>a) Fruit/Vegetable- Physical & Microscopic & Pectinolytic agent<br>b) Meat - Proteolytic, lipolytic, sacchrolytic<br>7. Determination of TDT and TDP<br>8. Determination of Salt and sugar tolerance<br>9. Determination of MIC of a Chemical preservative<br>10. Visit to Food/Dairy industry | | |
| **Unit-III** | 11. RPT of Milk– RRT, MBRT, DMC<br>12. Microbiological Quality Control of Milk as per BIS/FSSSAI<br>13. Analysis of Cheese, Paneer, Butter, Yogurt/curd as | | |

| | | | |
|---|---|---|---|
| | per BIS/FSSAI (Group experiment) | | |
| **Section- 3 Option A** | **Fermented Foods, Food Sanitation and Microbial Ecology** (Practicals Based On Unit-I,II & III Of USMB-403 Option A | **1 Credit (45 lectures)** | Self Study (45) |
| **Unit-I** | 1. Wine and Bread making<br>2. Isolation of lactic acid bacteria from fermented food-eg Idli, curd | | |
| **Unit-II** | 3. Isolation of *Staphylococcus aureus* from sweets and demonstrating its virulence.<br>4. Food adulteration | | |
| **Unit-III** | 5. Winogradskys Column of an aquatic ecosystem | | |
| **Section-3 Option B** | **Advances , Applications Of Microbiology and Soft Skills** (Practicals Based On Unit-I,II & III Of USMB-403 Option B | **1 Credit (45 lectures)** | Self Study (45) |
| **Unit-I** | 1. Study of biofilm: slide immersion tech and staining<br>2. Preparation of nano particles and study their antibacterial activity [D] | | |
| **Unit-II** | 3. Assignment on report writing<br>4. Writing an abstract from a given paper<br>5. Statistical analysis of given data | | |
| **Unit-III** | 6. Isolation of Azotobacter<br>7. Isolation of Rhizobium<br>8. Efficacy of biofertilizer | | |

## MODALITY OF ASSESSMENT

**Theory Examination Pattern:**

**Semester End Theory Assessment - 100%** Total Marks for Every Paper: **100 Marks**

Duration: 3 hrs Total No of Questions: 5

| Question No | Maximum Marks | Units Covered | Nature of Q | Internal Options | Example |
|---|---|---|---|---|---|
| 1 | 20 | All | Objective | None | all |
| 2 | 20 | All | Subjective | 60% | 4 out of 6 |
| 3 | 20 | Unit 1 | Subjective | 100% | 2 out of 4<br>Or 3 out of 6<br>Or 4 out of 8<br>Or 5 out of 10<br>**etc** |
| 4 | 20 | Unit 2 | Subjective | 100% | |
| 5 | 20 | Unit 3 | Subjective | 100% | |

## PRACTICAL EXAMINATION PATTERN

**Semester end practical examination):- 50 Marks Per Section**

Section-I based on course-1, Section-II based on course-2
& Section-III based on course-3 Option A or Option

| Sr.No. | Particulars | Marks Total |
|---|---|---|
| **1.** | **Laboratory work (Section-I, II, III A or B)** | **40 + 40 + 40 = 120** |
| **2.** | **Journal (Section-I, II, III A or B)** | **05 + 05 + 05 = 015** |
| **3.** | **Viva (Section-I, II, III A or B)** | **05 + 05 + 05 = 015** |
| | **Grand Total** | **50 + 50 + 50 = 150** |

## PRACTICAL BOOK / JOURNAL

**Semester III & IV**

For each semester end practical Examination, students are required to present a duly certified journal for appearing at the practical examination, failing which they will not be allowed to appear for the examination.

**In case of loss of Journal and/ or Report, a Lost Certificate should be obtained from Head/ Co-ordinator / In-charge of the department; failing which the student will not be allowed to appear for the practical examination.**

## Overall Examination and Marks Distribution Pattern

### Semester III

| Course | USMB-301 | USMB-302 | USMB- 303 Option A | OR | USMB- 303 Option B | |
|---|---|---|---|---|---|---|
| | External | External | External | | External | Total |
| Theory | 100 | 100 | 100 | | 100 | 300 |
| Practical | 50 | 50 | 50 | | 50 | 150 |

### Semester IV

| Course | USMB-401 | USMB-402 | USMB- 403 Option A | OR | USMB- 303 Option B | |
|---|---|---|---|---|---|---|
| | External | External | External | | External | Total |
| Theory | 100 | 100 | 100 | | 100 | 300 |
| Practical | 50 | 50 | 50 | | 50 | 150 |