

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			
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			
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)
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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

S.Y.B.Sc Microbiology: Detail Syllabus
Revised for Credit Based Semester & Grading System
To be implemented from the academic year 2017-18

Bachelor of Science in Microbiology Duration: Six Semesters			
SEMESTER III			
Course Code	Title	Credits	Notional Periods
USMB-301 Theory	Biomolecules and Microbial taxonomy	2 Credits (45 lectures)	Self Study (45)
Unit-I	Unit I: Estimation Of Biomolecules	15 Lectures	15
	1a. Macromolecular composition of a microbial cell	1	
	1b. Methods of elemental analysis: Carbon ,Nitrogen and Phosphorus	3	
	1c. Estimation of Proteins and amino acids Proteins by Biuret method (Direct and indirect) Amino acids by Ninhydrin method	3	
	1d. Estimation of Carbohydrates Total carbohydrates by Anthrone method Reducing Sugars (maltose) by DNSA method Reducing sugar Felhing's method	3	
	1e. Extraction of Lipids by Soxhlet method	1	
	1f. Estimation of Nucleic acids General principles and extraction of nucleic acids DNA by DPA method RNA by Orcinol method	4	
Unit-II	Unit II: Nucleic acid structure and chemistry	15 Lectures	15
	2a. Nucleic Acid Structure DNA stores genetic information DNA molecules have distinctive base composition DNA is a double helix DNA can occur in different 3D forms DNA sequences adopt unusual structures Many RNAs have complex 3D structures	15	
	2b. Nucleic acid chemistry Denaturation of double helical DNA and RNA Nucleic acid from different species can form hybrids Nucleotides and nucleic acids undergo non enzymatic transformations DNA methylation		
	2c. Other Functions of nucleotides		
	2d. Structures of chromosomes of eukaryotic cell		
Unit-III	Unit III. Microbial Taxonomy	15 Lectures	15
	3a. Introduction to microbial taxonomy Systems of classification(Cavalier Smith 6 kingdom) Bergey's manual The three domain concept based on phylogeny Nomenclature Taxonomic ranks	4	

	Numerical Taxonomy		
	3b. Methods of analysis used in classification : Phenotypic analysis (Morphological characteristics, Physiological and metabolic characteristics, Biochemical characteristics, Ecological characteristics, Fatty acid analysis)	2	
	3c. Genetic analysis DNA-DNA hybridization DNA profiling Multilocus sequence analysis G+C ratio Genetic finger printing	4	
	3d. Amino acid sequencing	1	
	3e. Phylogenetic analysis Nucleic acid sequencing Analysis of individual genes Multilocus gene sequence analysis Whole genome sequence analysis	3	
	3f. Phylogenetic tree: Types	1	

REFERENCES: USMB 301

1. Methods In Microbiology, Vol.5B, Ed. Norris & Ribbon, Academic Press
2. A handbook book of Organic analysis: qualitative and quantitative 4th edition, Hans Thacher Clarke, CBS publishers & distributors , New Delhi.
3. Laboratory Manual in Biochemistry, J. Jayaraman, (2003) New Age International

Publishers

4. Lehninger: Principles Of Biochemistry, 4th Ed., D. Nelson & M. Cox, W.H. Freeman & Co., (LPE)
5. Prescott's Microbiology, J.M. Willey, L.M. Sherwood, C.J. Woolverton, (2011) 8th edition, McGraw-Hill International edition
6. Prescott, Harley and Klein's Microbiology, Willey, Sherwood, Woolverton (2008) 7th edition, McGraw-Hill International edition
7. Brock Biology of Microorganisms, Madigan, Martinko, Dunlap and Clark (2009) 12th edition, Pearson Education
8. Peter J. Russell (2006), "Genetics-A molecular approach", 2nd ed. 2

Additional references

1. General Microbiology / Stanier R.Y. And Other, MacMillan (1989) 5th edition
2. Molecular Biotechnology : Principles And Applications Of Recombinant Dna / Glick, Bernard; Pasternak, Jack 2003
3. An Introduction To Practical Biochemistry / Plummer David (1979) TMH

S.Y.B.Sc Microbiology: Detailed Syllabus
Revised for Credit Based Semester & Grading System
To be implemented from the academic year 2017-18

SEMESTER IV			
Course Code	Title	Credits	Notional Periods
USMB-401 Theory	Metabolism & Basic Analytical Techniques	2 Credits (45 lectures)	Self Study (45)
Unit-I	Introduction To Metabolism & Bioenergetics	15 Lectures	15
	1a Introduction to metabolism, Metabolic pathways	2	
	1b Organic reaction mechanism	3	
	1c Experimental approaches to study metabolism	10	
	1d Thermodynamics of Phosphate compounds		
	1e Oxidation-reduction reactions		
1f Thermodynamics of life			
Unit-II	Enzyme Kinetics	15 Lectures	15
	2a. Introduction of Enzymes: General properties of enzymes How do enzymes accelerate reaction Rate law for a simple catalysed reaction, Michaelis-Menten equation and its derivation Lineweaver Bruck plot Classification of enzymes	6	
	2b. Overview of Coenzyme: Coenzymes: Different types and reactions catalyzed by coenzymes (in tabular form) Nicotinic acid: structure, occurrence & biochemical function	2	
	2c. Enzyme Kinetics: Saturation kinetics Effect of temperature and pH Effect of Inhibitors- Reversible and irreversible, competitive, Non competitive and uncompetitive inhibitors Multisubstrate reactions- Ordered, Random and pingpong reactions Allosteric effects in enzyme catalysed reactions- Koshland-Nemethy and Filmer model & Monod, Wyman and Changeux model	7	
Unit-III	Analytical techniques	15 Lectures	15
	3a. Chromatography Introduction to chromatography, types of chromatography Paper chromatography: Principle, circular, ascending and descending Paper Chromatography, Separation of amino acids and monosaccharides by Paper Chromatography. Thin layer chromatography : principle, preparation of TLC plates, procedure for TLC, preparative TLC, 2D TLC [one paragraph], HPTLC-[1 page],	8	

	Separation of amino acids and sugars by TLC. Column chromatography : Introduction & principle Exclusion chromatography , gel chromatography		
	3b. Centrifugation Introduction : basic principles of sedimentation Types, care and safety aspects of centrifuges, types of rotors , care and maintenance, safety & centrifugation Preparative centrifugation & its applications, Analytical centrifugation and its application	5	
	3c. Electrophoresis General principles, support media –agarose gels, polyacrylamide gels	2	

	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)		

REFERENCES: USMB 401

1. Principles of Biochemistry- G. Zubay, W.W. Parson, D.E.Vance. Wm.C.Brown Publishers
2. Fundamentals of Biochemistry. D. Voet and J. Voet Publisher Wiley plus Edition 5th.
3. Lehninger- Principles of Biochemistry- David Nelson, Michael Cox. 4th edition W.H. Freeman & Company[Low price edition- for sale in India, Pakistan, Sri Lanka, Bangladesh, Nepal & Bhutan]
4. Instrumental Methods of chemical analysis, V.K. Ahluwalia, Ane Books Pvt.Ltd; 2015.
5. Principles & techniques of Biochemistry & Mol biology 6th ed, Keith Wilson & John Walker, Cambridge University press, 2006
6. Laboratory manual in Biochemistry- J. Jayaraman

MODALITY OF ASSESSMENT

Theory Examination Pattern:

Semester End Theory Assessment - 100%

Duration: 3 hrs

Total Marks for Every Paper: **100 Marks**

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 Or 3 out of 6 Or 4 out of 8 Or 5 out of 10 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	O R	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	O R	USMB-303 Option B		
	External	External	External			External	Total
Theory	100	100	100			100	300
Practical	50	50	50			50	150