

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

USMB-302 Theory	Environmental Microbiology	2 Credits (45 lectures)	Self Study (45)
Unit-I	Unit I: Air Microbiology	15 Lectures	15
	1a. Aeromicrobiology: Important airborne pathogens and toxins, Aerosols, nature of bioaerosols, aeromicrobiological pathway, microbial survival in the air, extramural aeromicrobiology, intramural aeromicrobiology	7	
	1b. Sampling Devices for the Collection of Air Samples, Detection of microorganisms on fomites	3	
	1c. Air Sanitation	2	
	1d. Air Quality Standards	3	
Unit-II	Unit II : Fresh Water and Sewage Microbiology	15 lectures.	15
	Unit II (A) Fresh Water Microbiology: (7 Lectures)		
	2a. Fresh water environments and micro-organisms found in Springs, rivers and streams, Lakes , marshes and bogs	3	
	2b. Potable water: Definition, water purification ,water quality standards and pathogens transmitted through water	2	
	2c. Microbiological analysis of water: Indicator organisms and their detection in water- Total Coliforms, Fecal Coliforms and <i>E. coli</i> , Fecal <i>Streptococci</i> , <i>Clostridium perfringens</i>	2	
	Unit II (B) Sewage Microbiology : (8 Lectures)		
	2d Modern Waste Water treatment: Primary, Secondary and Tertiary Treatment . The	1	
	2e. nature of wastewater and Monitoring of waste water treatment process(BOD,COD)	2	
	2f. Removal of Pathogens by Sewage treatment Processes	1	
	2g. Oxidation Ponds and Septic tanks	1	
2h. Sludge Processing	1		

	2i. Disposal of treated waste water and biosolids.	2	
Unit-III	Unit III: Soil and Geo Microbiology:	15 lectures.	15
	3a. Terrestrial Environment Soil- Definition, Composition, function , Textural triangle Types of soil microorganisms and their activities	2	
	3b. Methods of studying soil microorganisms: Sampling, Cultural methods, Physiological methods, Immunological methods, Nucleic acid based methods, Radioisotope techniques	5	
	3c. Biogeochemical Cycles: Carbon cycle, Nitrogen cycle, Sulphur cycle, Phosphorus Cycle, Iron cycle	6	
	3d. Soil Bioremediation	2	

REFERENCES: USMB 302

1. Environmental Microbiology , 2nd Edition; Raina M. Maier, Ian L. Pepper, Charles P.Gerba, 2010 Academic Press
2. Fundamental Principles of Bacteriology , 7th Editon; A.J. Salle ,Tata Mc Graw Hill Publishing Company
3. Air Quality Standards- NAAQS Manual , Volume I
4. Prescott's Microbiology, 8th Edition; Joanne M. Willey, Linda M. Sherwood, Christopher J.Woolverton,2011, Mc Graw Hill International Edition
5. Fundamentals of Microbiology, 9th Edition , Frobisher, Hinsdill, Crabtree, Goodheart, 1974, Saunders College Publishing
6. Introduction to Environmental Microbiology – Barbara Kolwzan , Waldemar Adamiak (E Book)
7. Soil Microbiology-4th Edition, N.S Subba Rao,2000, Oxford and IBH Publishing Co. Pvt Ltd

USMB-402 Theory	Applied Microbiology	2 Credits (45 lectures)	Self Study (45)
Unit-I	Host defence and public health (Epidemiology of infectious diseases)	15 lectures	
	Innate immunity and immune system (11 Lectures)		
	1a. Classification of immune system (innate immunity & acquired immunity)	2	
	1b. Physical barriers in non specific innate resistance revision. Chemical barriers (Complement: principle & significance (no pathway), Cytokines: interferon, antimicrobial peptides, bacteriocins)	4	
	1c. Cells of immune system: Haematopoiesis, lymphocytes, monocytes & macrophages, granulocytes, mast cells, dendritic cells & NK cells	2	
	1d. Phagocytosis & Inflammation	3	
	Epidemiology of infectious diseases (4 Lectures)		
	1e. Tools of epidemiology, recognition of an infectious disease in population	4	
	1f. Spread of infection: Reservoirs and transmissions. Nosocomial infections: Micro organism in hospital, compromised host, chain of transmission, control of nosocomial infection.	4	
Unit-II	Food Microbiology	15 lectures.	15
	2a. Introduction, Food as a substrate for microorganism a. pH, aw, O-R potential b. Nutrient Content c. Accessory food substances d. Inhibitory substances & biological structure e. Combined effects of factors affecting growth	2	
	2b. Food Control Enforcement & Control Agency: International agencies, Federal agencies (FDA, USDA), FSSAI[website], Introduction to HACCP	1	

	<p>2.c Important Microorganisms in Food Microbiology: General characteristics of the enlisted organisms to be studied wrt spoilage and transmission of infection/intoxication (no clinical features and structural details)</p> <p>A. Spoilage -causing microorganisms</p> <p>a. Yeast & Molds: <i>Saccharomyces</i>, <i>Aspergillus</i> & <i>Penicillium</i></p> <p>b. Bacteria: <i>Bacillus</i>, <i>Clostridium</i>, <i>Flavobacterium</i>, <i>Pseudomonas</i></p> <p>B. Food-borne Illness associated Microorganisms: Classification of Food-borne diseases (Schematic). Bacteria responsible for food -borne intoxication and infections-overview/tabulation. Examples of non-bacterial food-borne pathogens</p> <p>Details of :</p> <p>a) Staphylococcus food intoxication (organism, enterotoxin, incidence, foods involved, prevention of outbreaks) b) Salmonellosis (organism, source, incidence, foods involved, outbreak-conditions & prevention)</p>	5	
	<p>2d. Food Spoilage, General Principles of spoilage of:</p> <p>a. Fruits and vegetables</p> <p>b. Meat (including spoilage under aerobic & anaerobic conditions- exclude spoilage of different kinds of meats)</p> <p>c. Canned foods</p>	3	
	<p>2e. General Principles of Food Preservation:</p> <p>a. Preservation using High temperature (including TDT, D, F, Z values, 12D concept), principle of canning</p> <p>b. Low temperature</p> <p>c. Drying</p> <p>d. Food preservatives (organic acids & their salts, Sugar & salt)</p> <p>e. Ionizing radiations</p>	4	
	<p>2f. Methods of microbial examination of foods:</p> <p>a. Homogenization of food samples</p> <p>b. Methods- SPC, spiral plater, membrane filters, dry films, surface examination-swab rinse & contact plate methods.</p> <p>c. Enlist the following methods giving their application only- Impedance, microcalometry, thermostable nuclease, LAL test, PCR, ATP, whole animal assay, Ligase loop technique</p>	3	
Unit-III	Dairy Microbiology	15 lectures.	15
	3a. Raw and fluid milk products Pasteurization & Ultra-pasteurization	2	
	3b. Concentrated and dry milk, whey	2	
	3c. Microbiology of butter	1	
	3d. Fermented milk: Yogurt, cultured buttermilk and fermented milk in India	3	

	3e. Cheese: Cheddar, Cottage, Processed Cheese, Cheese Defects. Enlist other cheese and associated microorganisms	4	
	3g. Microbiological Quality of Milk & Milk Products: SPC, coliform count, LPC, thermophilic, psychrophilic counts and RPT (RRT, MBRT, DMC)	3	

REFERENCES: USMB 401

REFERENCES: USMB 402

1. Prescott, Harley Klein. Mc Graw international edition, 7th Ed
2. Anantnarayan & Paniker's edtn 8th. University press
3. Food Microbiology by Frazier 5th ed
4. Modern Food Microbiology by James Jay 6th ed
5. Applied Dairy Microbiology by Martha & Steele
6. BIS standards, FSSAI
7. Outlines of Biochemistry. E.E. Conn & P.K.Stumpf ,G. Bruening, R.N.Doi. 5th Edition, John Wiley and sons

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