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UNIVERSITY OF MUMBAI



Revised Syllabus for F.Y.B.Sc.

Program: B.Sc.

Course:MICROBIOLOGY(USMB)

(Choice Based Credit System with effect from the
Academic year 2016-17)

PREAMBLE

With the introduction of Choice Based Credit System (CBCS) by the esteemed University from the academic year 2016-2017, the existing syllabus of F.Y.B.Sc. Microbiology is restructured according to the CBCS pattern for its implementation from 2016-2017.

While earlier revision of the syllabus took care of balancing both the basic techniques and some of the advance techniques (as remaining will be introduced phase wise at S.Y.B.Sc. and T.Y.B.Sc level) in Microbiology, the present revision is related to restructuring of syllabus as per CBCS pattern.

The concepts of **Biosafety, Validation, Calibration and SOPs** have been introduced to make the learners aware about :-

- i. The biological hazards and safety measures
- ii. Importance of Validation and Calibration of Scientific equipments in industries and laboratories.
- iii. Writing of SOPs for instruments and their importance at work.

The unique chemistry of living systems results in large part from the remarkable and diverse properties of **Biomacromolecules**. Macromolecules from each of the four major classes may act individually in a specific cellular process, where as others associate with one another to form supramolecular structures. All of these structures are involved in important cellular processes. Since the arrival of information technology, biochemistry has evolved from an interdisciplinary role to becoming a core program for a new generation of interdisciplinary courses such as **bioinformatics and computational biochemistry**. Hence the module of macromolecules has been included in the revised syllabus to teach students the structure and function of biomolecules at an entry level with an objective to raise the student's awareness of the applicability of microcomputers in biochemistry as they go to the higher classes.

F.Y.B.Sc Microbiology Syllabus (General Outline)
Revised for Choice Based Credit System
To be implemented from the Academic year 2016-17

SEMESTER I		
Course Code	Title	Credits
USMB-101 Theory	FUNDAMENTALS OF MICROBIOLOGY.	2 Credits (45 lectures)
Unit-I	History, Introduction & Scope Of Microbiology Prokaryotic Cell Structure,	15 lectures.
Unit-II	Eukaryotic Cell Structure Biosafety In Microbiology	15 lectures.
Unit-III	Macromolecules	15 lectures.
USMB-102 Theory	BASIC TECHNIQUES IN MICROBIOLOGY.	2 Credits (45 lectures)
Unit-I	Microscopy & Staining	15 lectures.
Unit-II	Control Of Microorganisms	15 lectures.
Unit-III	Microbial Nutrition, Cultivation, Isolation & Preservation	15 lectures.
USMBP-1	PRACTICALS	2 Credits
	SECTION-1 FUNDAMENTALS OF MICROBIOLOGY. (Practicals Based On Unit-I, II & III Of USMB-101)	1 Credit (45 lectures)
	SECTION-2 BASIC TECHNIQUES IN MICROBIOLOGY. (Practicals Based On Unit-I, II & III Of USMB-102)	1 Credit (45 Lectures)
SEMESTER II		
USMB-201 Theory	BASICS OF MICROBIOLOGY.	2 Credits (45 Lectures)
Unit-I	Study Of Different Groups Of Microbes-I	15 lectures.
Unit-II	Study Of Different Groups Of Microbes-II	15 lectures.
Unit-III	Microbial Growth	15 lectures.
USMB-202 Theory	EXPLORING MICROBIOLOGY.	2 Credits (45 Lectures)
Unit-I	Microbial Interactions	15 lectures.
Unit-II	Microbes & Human Health	15 lectures.
Unit-III	Advance Techniques In Microbiology & Instrumentation	15 lectures.
USMBP-2	PRACTICALS	2 Credits
	SECTION-1 BASICS OF MICROBIOLOGY. (Practicals Based On Unit-I, II & III Of USMB-201)	1 Credit (45 Lectures)
	SECTION-2 EXPLORING MICROBIOLOGY. (Practicals Based On Unit-I, II & III Of USMB-202)	1 Credit (45 Lectures)

F.Y.B.Sc Microbiology: Detail Syllabus
Revised for Credit Based Semester & Grading System
To be implemented from the academic year 2014-15

Bachelor of Science in Microbiology Duration: Six Semesters			
SEMESTER I			
Course Code	Title	Credits	Notional Periods
USMB-101 Theory	FUNDAMENTALS OF MICROBIOLOGY.	2 Credits (45 lectures)	Self Study (45)
Unit-I	<p>1.1 History, Introduction & Scope Of Microbiology:</p> <ul style="list-style-type: none"> a. Discovery of microorganisms b. Conflict over spontaneous generation c. Golden Age Of Microbiology-Koch Postulate, Medical Microbiology, Immunology d. Development of industrial microbiology and microbial ecology e. Scope and relevance of microbiology f. Future of microbiology <p>1.2 Prokaryotic Cell Structure and functions:</p> <ul style="list-style-type: none"> a. Cell wall b. Cell membrane c. Components external to cell wall-Capsule, Slime layer, Flagella, Pili, Fimbriae d. Cytoplasmic matrix-Inclusion bodies, magnetosomes, ribosomes, gas vesicles e. Nucleoid, Plasmids f. Bacterial endospores and their formation 	15 lectures. (03 + 12 Lec.)	15
Unit-II	<p>2.1 Eukaryotic Cell Structure:</p> <ul style="list-style-type: none"> a. Overview of Eucaryotic cell structure b. The plasma membrane and membrane Structure c. Cytoplasmic matrix, microfilaments, intermediate filaments, and microtubules d. Organelles of the Biosynthetic-secretory and endocytic pathways –Endoplasmic reticulum & Golgi apparatus. Definitions of Lysosome, Endocytosis, Phagocytosis, Autophagy, Proteasome e. Eucaryotic ribosomes f. Mitochondria g. Chloroplasts h. Nucleus –Nuclear Structure i. External Cell Coverings: Cilia And Flagella j. Comparison Of Prokaryotic And Eukaryotic Cells <p>2.2 Biosafety In Microbiology:</p> <ul style="list-style-type: none"> a. Means of laboratory infection 	15 lectures. (12 + 03 Lec.)	15

	<ul style="list-style-type: none"> b. Potentially hazardous procedures c. Responsibility d. Risk Assessment e. Restricted access f. Safety equipments g. Immunization and medical records h. Training of personnel i. Laboratory procedures j. Levels of Containment 		
Unit-III	<p>Macromolecules</p> <p>3.1 Chemical foundations:</p> <ul style="list-style-type: none"> a. Biomolecules as compounds of carbon with a variety of functional groups. b. Universal set of small molecules. c. Macromolecules as the major constituents of cells. d. Configuration and Conformation with definitions and suitable examples only. e. Types of Stereoisomers and importance of stereoisomerism in biology. f. Types of bonds and their importance: Electrovalence, covalent, ester, phosphodiester, thioester, peptide, glycosidic <p>3.2 Water- Structure, properties in brief.</p> <p>3.3 Carbohydrates: Definition, Classification, Biological role. Monosaccharides, oligosaccharides (maltose, cellobiose, sucrose, lactose) and polysaccharide (starch, glycogen, peptidoglycan, cellulose)</p> <p>3.4 Lipids: Fatty acids as basic component of lipids and their classification (Lehninger), nomenclature, storage lipids and structural lipids. Types of lipids with general structure of each and mention examples.</p> <p>3.5 Amino acids & proteins: General structure and features of amino acids (emphasis on amphoteric nature) Classification by R-group, Uncommon amino acids and their functions Peptides and proteins- Definition and general features and examples with biological role. Primary, secondary, tertiary, quaternary structures of proteins- Brief outline.</p> <p>3.6 Nucleic acids: Nitrogenous bases- Purines, Pyrimidines Pentoses-Ribose, Deoxyribose, Nomenclature of Nucleosides and nucleotides, N-β-glycosidic bond, polynucleotide chain to show bonding between nucleotides (Phosphodiester bonds). Basic structure of RNA and DNA.</p>	<p>15 lectures.</p> <p>02 Lec.</p> <p>01 Lec.</p> <p>04 Lec.</p> <p>03 Lec.</p> <p>03 Lec.</p> <p>02 Lec.</p>	15

	SEMESTER II		Notional Periods
USMB-201 Theory	BASICS OF MICROBIOLOGY.	2 Credits (45 lectures)	Self Study (45)
Unit-I	<p>Study Of Different Groups Of Microbes-I:</p> <p>1.1 Viruses: a) Historical highlights, General properties of viruses, prions, viroids b) Structure of viruses-capsids, envelopes, genomes, c) Cultivation of viruses- overview d) Bacteriophages: Lytic cycle. Lysogeny, Structure and Life cycle of T4 phage.</p> <p>1.2 Rickettsia, Coxiella, Chlamydia, Mycoplasma: general features, medical significance</p> <p>1.3 Actinomycetes: General features of Nocardia and Streptomyces Importance: ecological, commercial and medical</p> <p>1.4 Archaea: Introduction- Major Archaeal physiological groups, Archaeal cell wall, lipids and membranes, Ecological importance</p>	15 lectures. 07 Lectures 03 Lectures 02 Lectures 03 Lectures	15

Unit-II	Study Of Different Groups Of Microbes-II: Classification, Morphological characteristics, cultivation, reproduction and significance 2.1 Protozoa- Major Categories of Protozoa Based on motility, reproduction. Medically important Protozoa Life cycle of Entamoeba 2.2 Algae - Characteristics of algae: morphology, Pigments, reproduction Cultivation of algae. Major groups of Algae –an overview. Biological, Medical and economic importance of Algae. Differences between Algae and Cyanobacteria 2.3 Fungi and Yeast- Characteristics: structure, Reproduction. Cultivation of fungi and yeasts. Major fungal divisions- overview. Life cycle of yeast, Biological and economical importance 2.4 Slime molds and Myxomycetes	15 lectures. 04 Lectures 05 Lectures 05 Lectures 01 Lecture	15
Unit-III	Microbial Growth: 3.1 a. Definition of growth, Mathematical Expression, Growth curve b. Measurement of growth c. Direct microscopic count – Breed’s count ,Petroff – Hauser counting chamber- Haemocytometer. d. Viable count – Spread plate and Pour plate technique e. Measurements of cell constituents. f. Turbidity measurements – Nephelometer and spectrophotometer techniques g. Synchronous growth, Continuous growth (Chemostat and Turbidostat) h. Influence of environmental factors on growth. i. Microbial growth in natural environment. j. Counting viable non-culturable organisms-Quorum sensing techniques	15 lectures.	15
USMB-202 Theory	EXPLORING MICROBIOLOGY.	2 Credits (45 lectures)	Self Study (45)
Unit-I	Microbial Interactions: 1.1 Types of Microbial Interactions : Mutulism, Cooperation, Commensalisms, Predation Parasitism, Amensalism, Competition 1.2 Human Microbe Interactions . a) Normal flora of the human body : Skin, Nose & Nasopharynx, Oropharynx, Respiratory tract, Eye, External ear, Mouth, Stomach, Small intestine, Large intestine, Genitourinary tract . b) Relationship between microbiota& the host . c) Gnotobiotic animals 1.3 Microbial associations with vascular plants a) Phyllosphere	15 lectures.	15

	4. Static & Shaker Cultures 5. Fungal Wet mounts & Study of Morphological Characteristics :Mucor,Rhizopus,Aspergillus, Penicillium, 6. Permanent slides of Algae, Protozoa		
Unit-III	7. Growth curve (Demonstration) only in complex media. 8.Breed's Count 9.Haemocytometer 10.Viable count: Spread plate and pour plate 11.Brown's opacity 12.Effect of pH and temperature on growth 13.Measurement of cell dimensions-Micrometry		
	SECTION-2 EXPLORING MICROBIOLOGY.	1 Credit (45 lectures)	Self Study (45)
Unit-I	1. Normal flora of the Skin & Saliva 2. Wet Mount of Lichen 3. Bacteroid Staining & Isolation of Rhizobium 4. Azotobacter isolation & staining		
Unit-II	6.Study of virulence factors – Enzyme Coagulase 7.Study of virulence factors – Enzyme Hemolysin 8.Study of virulence factors – Enzyme Lecithinase		
Unit-III	9.Use of standard buffers for calibration and determination of pH of a given solution 10.Determination of λ_{max} & Verification of Beer Lambert's law 11.Determination & efficiency of Autoclave, Hot air oven , LAF 12.Writing of SOP's for Instruments 13.Visit to a Microbiology laboratory in a research Institute		

REFERENCES: USMB 101 & USMB 201

1. Prescott ,Hurley.Klein-Microbiology, 7th edition, International edition, McGraw Hill.
2. Kathleen Park Talaro& Arthur Talaro - Foundations in Microbiology International edition 2002,| McGraw Hill.
3. Michael T.Madigan & J.M.Martin,Brock ,Biology of Microorganisms 12th Ed. International edition 2006, Pearson Prentice Hall.
4. A.J.Salle,Fundamental Principles of Bacteriology.
5. Stanier.Ingraham et al ,General Microbiology 4th & 5th Ed. 1987, Macmillan Education Ltd
6. Microbiology TMH 5th Edition by Michael J.Pelczar Jr., E.C.S. Chan ,Noel R. Krieg
7. BIS:12035.1986: Code of Safety in Microbiological Laboratories

8. Outlines of Biochemistry 5/E, Conn P. Stumpf, G. Bruening and R. Doi. John Wiley & Sons. New York 1995
9. Lehninger. Principles of Biochemistry. 4th Edition. D. Nelson and M. Cox. W.H. Freeman and Company. New York 2005
10. Microbiology An Introduction. 6th Edition. Tortora, Funke and Case. Adisson Wesley Longman Inc. 1998.

REFERENCES: USMB 102& USMB 202

1. Microbiology TMH 5th Edition by Michael J.Pelczar Jr., E.C.S. Chan ,Noel R. Krieg
2. A.J.Salle, Fundamental Principles of Bacteriology,McGraw Hill Book Company Inc.1984
3. Cruikshank, Medical Microbiology , Vol -II
4. Prescott ,Hurley.Klein-Microbiology, 5th & 6th edition, International edition 2002 & 2006, McGraw Hill.
5. Michael T.Madigan & J.M.Martin,Brock ,Biology of Microorganisms 11th Ed. International edition ,2006, Pearson Prentice Hall.

MODALITY OF ASSESSMENT

Theory Examination Pattern:

(A) Semester End Theory Assessment -

100 Marks

- i. Duration - These examinations shall be of **3 Hours** duration.
- ii. Theory question paper pattern :-
 1. There shall be **four** questions. On each unit there will be one question with **25** Marks each & fourth one will be based on all the three units with **25** Marks.
 2. All questions shall be **compulsory** with internal choice within the questions. Question 1 (Unit-I),Question 2 (Unit-II) & Question 3 (Unit-III) & Question 4 (combined units) will be of **50** Marks with internal options.
 3. All Questions may be sub divided into sub questions of **five** marks objective questions and **twenty** marks of short or long questions of 5 to 10 marks each. Please ensure that the allocation of marks depends on the weightage of the topic

PRACTICAL EXAMINATION PATTERN

(B) External (Semester end practical examination) :- 50 Marks Per Section

(Section-I based on course-1 & Section-II based on course-2)

Sr.No.	Particulars	Marks	Total
1.	Laboratory work (Section-I + Section-II)	40 + 40	= 80
2.	Journal	05 +05	= 10
3.	Viva	05 + 05	= 10

PRACTICAL BOOK/JOURNAL

Semester I:

The 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 / Incharge of the department ; failing which the student will not be allowed to appear for the practical examination.

Semester II

The 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 / Incharge of the department ; failing which the student will not be allowed to appear for the practical examination.

Overall Examination and Marks Distribution Pattern

Semester I

Course	USMB-101	USMB-102	Grand Total
Theory	100	100	200
Practicals	50	50	100

Semester II

Course	USMB-201	USMB-202	Grand Total
Theory	100	100	200
Practicals	50	50	100