

SOPHIA COLLEGE

AUTONOMOUS

affiliated to

University of Mumbai

Proposed Syllabus for

Program: B.Sc.

Class: F.Y.B.Sc.

Course: MICROBIOLOGY

Implemented from

Year 2018-19

Learning Objectives:

Semester I:

- Learn the fundamental aspects of Prokaryotic and Eukaryotic Cell structure and function, and the differences between these cells.
- Learn and understand the principles of working of the light microscope.
- Learn about the various staining procedures.
- Learn about the microbial nutrition, cultivation, isolation, preservation and control of microorganisms.
- To be able to apply this knowledge in the laboratory.
- To develop analytical skills
- To think in a critical & creative manner

Semester II:

- Learn about various groups of organisms other than bacteria.
- Learn about microbial interactions.
- Learn about role of microbes in human health.
- Learn and understand the working and applications of Advanced Microscopes and other instrumental techniques.
- Learn concepts of microbial growth.
- Learn about the applications of microorganisms in various industries.
- Develop analytical and problem-solving skills
- Think in a critical and analytical manner

**F.Y.B.Sc MICROBIOLOGY Syllabus Revised for Autonomy
(General Outline)
Implemented from the Academic year 2018-19**

COURSE NAME: MICROBIOLOGY

Semester I		
PAPER CODE	PAPER Title	Credits
SBSMCB101	Fundamentals Of Microbiology	2 Credits (45 lectures)
Unit-I	History of Microbiology and Chemical basis of life	15 lectures.
Unit-II	Procaryotic Cell Structure And Function	15 lectures.
Unit-III	Eucaryotic Cell Structure And Function	15 lectures.
SBSMCB102	Basic Techniques In Microbiology	2 Credits (45 lectures)
Unit-I	Microscopy & Staining procedures	15 lectures.
Unit-II	Cultivation of Microorganisms	15 lectures.
Unit-III	Control of Microorganisms	15 lectures.
SBSMCBP1	PRACTICALS	2 Credits(45 lectures)
PRACTICAL – I	SECTION-1 Fundamentals Of Microbiology (Practicals Based On Unit-I, II & III Of SBSMCB101)	1 Credit
PRACTICAL –II	SECTION-2 Basic Techniques In Microbiology (Practicals Based On Unit-I, II & III Of SBSMCB102)	1 Credit
Semester II		
SBSMCB201	Exploring Microbiology	2 Credits (45 Lectures)
Unit-I	Study of Viruses, Rickettsia, Chlamydia, Actinomycetes and Archaea	15 lectures.
Unit-II	Microbial Interactions	15 lectures.
Unit-III	Microbes & Human Health	15 lectures.
SBSMCB202	Advanced and Applied Microbiology	2 Credits (45 Lectures)
Unit-I	Advanced Microscopy and Instrumentation	15 lectures.
Unit-II	Microbial Growth	15 lectures.
Unit-III	Microbial Technology	15 lectures.
SBSMCBP2	PRACTICALS	2 Credits(45 Lectures)
PRACTICAL – I	SECTION-1 Exploring Microbiology (Practicals Based On Unit-I, II & III Of SBSMCB201)	1 Credit
PRACTICAL –II	SECTION-2 Advanced and Applied Microbiology (Practicals Based On Unit-I, II & III Of SBSMCB202)	1 Credit

F.Y.B.Sc Microbiology: Detailed Syllabus implemented from the academic year 2018-19		
SBSMCB101	FUNDAMENTALS OF MICROBIOLOGY	2 Credits (45 lectures)
Unit-I	History of Microbiology and Chemical basis of life	15 lectures.
	1.1 History Of Microbiology a. History Of Microbiology b. Discovery of microorganisms c. Conflict over spontaneous generation d. Golden Age Of Microbiology-Koch Postulate, Medical Microbiology and Immunology 1.2 Chemical Basis of Life a. Types of bonds and their importance: Electrovalent, covalent, ester, phosphodiester, thioester, peptide and glycosidic. b. Water: Structure and Role of water. c. Definition, general characteristics and functions of i. Carbohydrates: Monosaccharides, Oligosaccharides (maltose, cellobiose, sucrose, lactose) and Polysaccharide (starch, glycogen, peptidoglycan, cellulose) ii. Lipids: Simple and complex lipids, storage and structural lipids. Liposomes and their applications iii. 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. Primary, secondary, tertiary, quaternary structures of proteins. iv. Nucleic acids: Nitrogenous bases- Purines, Pyrimidines, Pentoses-Ribose, Deoxyribose. Structure of RNA and DNA. Differences between A, B and Z forms of DNA. Other types of RNA- only names and application of si RNA.	01 01 01 01 01 01 01 01 03 04
Unit –II	Procaryotic Cell Structure And Function	15 lectures
	Bacteria 2.1 Morphology and Arrangement 2.2 Cell wall 2.3 Plasma membrane 2.4 Chromosome and plasmids. 2.5 Bacterial ribosomes. 2.5 Cytoplasmic matrix organic and inorganic inclusion bodies 2.6 Components external to cell wall: Capsule, Slime layer, Flagella, Pili, and Fimbriae. 2.7 Bacterial endospores.	02 02 02 01 01 02 03 02

Unit –III	Eucaryotic Cell Structure And Function	15 Lectures
	3.1 Comparison of Prokaryotic And Eukaryotic Cells	01
	3.2 Overview of eukaryotic cell structure:	01
	a. Plasma membrane and Cytoplasmic matrix,	01
	b. Endoplasmic reticulum and Golgi apparatus.	01
	c. Ribosomes and ribosomopathies.	01
	d. Mitochondria and Chloroplasts	02
	e. Nucleus –Nuclear Structure	01
	f. External cell coverings viz Cilia and Flagella.	01
	3.3 Morphological characteristics, Life Cycle, Cultivation, and significance of:	02
	a. Yeast and Molds (<i>Saccharomyces cerevisiae</i> and <i>Rhizopus</i>)	01
	b. Algae (<i>Chlamydomonas</i>)	02
	c. Slime Molds and Myxomycetes	01
	d. Protozoa (<i>Entamoebahistolytica</i>)	01
SBSMCB102	BASIC TECHNIQUES IN MICROBIOLOGY.	45 lectures
Unit-I	Microscopy & Staining procedures	15 lectures
	1.1 Microscopy:	
	a. History of microscopy	01
	b. Structure and functions of different parts of a microscope	01
	c. Magnification, resolving power, Numerical aperture, Use of oil immersion objective	02
	d. Simple and compound light microscope	02
	e. Dark field Microscope	01
	f. Phase contrast microscope	01
	1.2 Staining procedures	
	a. Stains: Types of stains (Acidic, Basic, Compound)	01
	b. Fixatives, Mordants and Decolorizers.	01
	c. Simple and differential staining (Gram and Acid Fast)	02
	d. Special staining (Cell wall, Capsule, Lipid granules ,Spores, Metachromatic granules & Flagella)	03
Unit –II	Cultivation of Microorganisms	15 lectures
	2.1 Nutritional requirements – Macro and Micronutrients	01
	2.2 Utilization of Carbon, Oxygen, Hydrogen, Nitrogen, Phosphorus, Sulfur and growth factors.	02
	2.3 Nutritional types of microorganisms	02
	2.4 Types of Culture media with examples	04
	2.5 Isolation of microorganisms and pure culture techniques	02
	2.6 Cultivation of anaerobes	02
	2.7 Preservation of microorganisms & Culture Collection Centres	02
Unit-III	Control of Microorganisms	15 Lectures

	<p>3.1 Definition and Factors affecting the effectiveness of antimicrobial agents</p> <p>3.2 Physical methods of microbial control</p> <ol style="list-style-type: none"> Moist and Dry heat Radiation Filtration Low temperature High pressure Dessication and Osmotic pressure <p>3.3 Chemical methods of microbial control</p> <ol style="list-style-type: none"> Phenolics Alcohols Heavy metals Halogens Quaternary ammonium compounds Sterilizing gases Surface active agents Aldehydes Peroxgens Biguanides (Chlorhexidine) <p>3.4 Evaluation of effectiveness of chemical antimicrobial agents</p>	<p>01</p> <p>02</p> <p>01</p> <p>01</p> <p>01</p> <p>01</p> <p>01</p> <p>05</p> <p>02</p>
	PRACTICALS	2 Credits
SBSMCBP1	SECTION-1 FUNDAMENTALS OF MICROBIOLOGY.	1 Credit (45 lectures)
Unit-I	<p>Qualitative detection :</p> <ol style="list-style-type: none"> Carbohydrates- Benedicts and Molisch's test. Proteins- Biuret Amino acids-Ninhydrin. Nucleic acid detection - DPA and Orcinol. <p>Assignment: Contribution of Scientists in the field of Microbiology or Types of bond and their significance in macromolecules (Diagram & Write up/Poster making/ Model making)</p>	
Unit-II	<p>Special staining:</p> <ol style="list-style-type: none"> Cell wall. Demonstration of Capsule. Endospore. Lipid. Metachromatic granules. Flagella staining (Demonstration) Study of Motility (Hanging Drop Preparation) <p>Student activity: Observing intracellular inclusions of algae/ protozoa in natural environments using phase contrast microscope.</p>	

Unit-III	<p>12. Isolation of <i>Saccharomyces cerevisiae</i>.</p> <p>13. Study of Morphological characteristics (Wet mount): Rhizopus</p> <p>14. Cultivation of fungi</p> <p style="padding-left: 20px;">a. On Sabourauds agar</p> <p style="padding-left: 20px;">b. Using Static & Shaker conditions</p> <p>15. Study of Permanent slides of Algae and Protozoa.</p> <p>Assignment: Tabulation of characteristics indicating similarities and differences amongst algae, protozoa and fungi.</p>	
	<p>SECTION-2 BASIC TECHNIQUES IN MICROBIOLOGY.</p>	<p>1 Credit (45 lectures)</p>
Unit-I	<p>1. Use and care of a microscope.</p> <p>2. Dark field and Phase contrast Microscope: Demonstration</p> <p>3. Monochrome and Negative Staining.</p> <p>4. Differential staining procedures:</p> <p style="padding-left: 20px;">a. Gram staining</p> <p style="padding-left: 20px;">b. Acid fast staining (Observing stained slide)</p> <p>Assignment: Tabulation of names, morphology, arrangement, Gram nature and motility of 10 common microorganisms with diagrams.</p>	
Unit-II	<p>5. Introduction to Laboratory equipments, disinfection & discarding techniques in laboratory</p> <p>6. Methods of sterilization of glass and plasticware (Pipettes, Petri Plates, Flasks, Micropipettes, tips and Microtitre plates)</p> <p>7. Sterilization of microbiological media</p> <p>8. Inspissation (Demonstration)</p> <p>9. Type of filters and Efficiency of filtration (Demonstration)</p> <p>10. Effect of UV Light and Osmotic pressure on microorganisms. (Demonstration)</p> <p>11. Testing antimicrobial activity of dyes/ disinfectants (disc diffusion method)</p> <p>Student activity: Testing antimicrobial activity of herbal extracts</p>	
Unit-III	<p>12. Preparation of Culture Media:</p> <p style="padding-left: 20px;">a. Liquid medium (Nutrient Broth)</p> <p style="padding-left: 20px;">b. Solid Media (Nutrient agar, Sabourauds agar)</p> <p style="padding-left: 20px;">c. Preparation of slant, butts & plates</p> <p>13. Inoculation techniques and Study of Growth:</p> <p style="padding-left: 20px;">a. Inoculation of Liquid Medium</p> <p style="padding-left: 20px;">b. Inoculation of Solid Media (Slants, Butts and Plates)</p> <p>14. Study of Colony Characteristics of pigment & non-pigment producing bacteria.</p> <p>15. Use of special purpose Media:</p> <p style="padding-left: 20px;">a. Differential & Selective (MacConkey Agar)</p> <p style="padding-left: 20px;">b. Enriched and differential : Blood agar</p> <p>Student activity: Carrying out preservation of fungal / bacterial culture using any two methods of preservation.</p>	
	Visit to Microbiology laboratory in a research Institute	

	SEMESTER II	
SBSMCB201	EXPLORING MICROBIOLOGY	45 lectures
Unit-I	Study Of Viruses, Rickettsia, Chlamydia, Actinomycetes and Archae	15 Lectures
	1.1 Viruses: a Historical highlights, general properties of viruses, prions and viroids. b. Structure of viruses-capsids, envelopes and genomes. c. Overview of cultivation of viruses. d. Bacteriophages: Lytic cycle, Lysogeny, Structure and Life cycle of T4 phage and lambda phage.	03 02 02 04
	1.2 Rickettsia and Chlamydia: General characteristics, diseases and vectors.	02
	1.3 Actinomycetes: General characteristics and Significance.	01
	1.4 Introduction to Archea.	01
Unit- II	Microbial Interactions	15 Lectures
	2.1 Types of Microbial Interactions: a. Mutualism: Lichens, Rhizobia, Mycorrhizae and Frankia. b. Commensalism: Normal flora of the human body, relationship between microbiota and the host. c. Normal flora of i. Skin, ii. Respiratory tract, iii. Gastrointestinal tract and iv. Genitourinary tract. d. Amensalism e. Predation and Parasitism	04 04 01 01
	2.2 Role of microorganisms in cycling of nutrients. Carbon, Nitrogen, Sulphur, Phosphorus and Iron.	05
Unit-III	Microbes & Human Health	15 lectures
	3.1 Important terminologies Infection and disease: Primary and secondary infections, Contagious infections, Opportunistic pathogens, Zoonoses and Vector borne infections.	01
	3.2 Germ free animals and Significance of Gnotobiotic studies	01
	3.3 Factors affecting infection: a) Pertaining to Hosts: Natural, Species and Racial resistance. b) Pertaining to individual resistance. c) Microbial virulence factors in adherence, invasion, colonization and disease.	01 01 04
	3.4 Host defence against infection: An Overview a) First line of defence: Skin, respiratory tract, gastrointestinal tract, genitourinary tract and eyes. b) Second line of defence: Fever, Inflammation and Phagocytosis c) Third line of defence: Brief introduction to Immunity (active passive, natural and acquired)	02 02 03

SBSMCB202	Advanced and Applied Microbiology	2 Credits (45 lectures)
Unit I	Advanced Microscopy and Instrumentation	15 lectures
	1.1 Fluorescent and Confocal Microscope 1.2 Light and Electron Microscope: Comparison between the two. 1.3 Types of electron microscopes: TEM, SEM and scanning probe microscope (Principle, Construction, Working, Advantages, limitations and Applications). 1.4 Specimen preparation for Electron microscopy: Ultrathin sectioning, Negative stains, Surface replica, Shadow casting and Freeze etching 1.5 pH meter: Principle, Construction, Combined electrode, Working, Validation and Calibration. 1.6 Colorimeter: Principle, Construction, Working and Calibration	02 01 04 04 02 02
Unit-II	Microbial Growth	15 lectures
	Microbial Growth: 2.1 Definition of growth, Mathematical Expression and Growth curve 2.2 Measurement of growth a. Direct microscopic count and Haemocytometer. b. Viable count – Spread plate and Pour plate technique e. Measurements of cell constituents. f. Turbidity measurements – Nephelometer and spectrophotometer 2.4 Influence of environmental factors on growth, Ways to increase yield of microbes, Batch, fed-batch and continuous cultures 2.5 Microbial growth in natural environment-Biofilms. 2.6 Viable but non-culturable bacteria- definition and significance	02 02 02 02 03 01 01
Unit-III	Microbial Technology	15 lectures.
	3.1 Microbial technology and the four 'F' (Food, Feed, Fuel and Functional molecules) Overview a. Applications of microorganisms in Food industry -Fermented food products -Alcoholic beverages -Dairy Products --Probiotics b. Commercial Production of Microorganisms: -Feed / SCP production -Biofertilizers, -Biopesticides c. Products from Microorganisms: antibiotics, enzymes, vitamins, polysaccharides d. Bioconversions using microorganisms: -Microorganisms in Fuel production -Biomining and bioleaching of ores	01 02 02 02 02

	<p>3.2 Recombinant Microbial biotechnology</p> <ol style="list-style-type: none"> a. Bacterial genes, genomes and genetics b. Techniques of gene manipulation (outline) c. Genetically engineered microorganisms and their applications in <ol style="list-style-type: none"> i. Human health (Insulin) ii. Agriculture (BT cotton) iii. Environment (Bioremediation of Oil spill) iv. Research (reporter microbes) 	02 04
SBSMCBP2	PRACTICALS	2 Credits
	SECTION-1 Exploring Microbiology	1 Credit (45 lectures)
Unit-I	<ol style="list-style-type: none"> 1. Spot and plaque assay of Bacteriophage (Demonstration) 2. Slide Culture technique (Actinomycetes) 3. Enrichment and isolation of Thermophiles <p>Student activity: Isolation of halophiles from sea water/ Psychrophiles from frozen food</p>	
Unit-II	<ol style="list-style-type: none"> 4. Wet Mount of Lichen 5. Rhizobium: Staining & Isolation. 6. Azotobacter: Isolation & staining. 7. Normal flora: Isolation of microorganisms from skin and saliva <p>Student activity: Cultivation of bacteria involved in sulphur cycle (e.g. photosynthetic sulphur bacteria / sulphate reducing bacteria)</p>	
Unit-III	<ol style="list-style-type: none"> 8. Demonstration of WBC in blood (Blood smear) 9. Study of virulence factors – Enzyme Hemolysin 10. Study of virulence factors – Enzyme Lecithinase 11. Study of virulence factors – Enzyme Coagulase 12. Study of role of fomites in spread of diseases <p>Assignment: Preparation of chart/poster/model showing different WBCs and their role in human immune system</p>	
	SECTION-2 Advanced and Applied Microbiology	1 Credit (45 lectures)
Unit-I	<ol style="list-style-type: none"> 1. Use of standard buffers for calibration of the pH meter and determination of pH of a given solution. 2. Determination of λ_{\max} of coloured solutions. 3. Verification of Beer's law. <p>Assignment Collect and make a collage of SEM & TEM images of Eukaryotic organelles / cells</p>	

Unit-II	Enumeration of bacteria by 4. Breed's Count. 5. Haemocytometer. 6. Brown's opacity tubes. 7. Measurement of cell dimensions-Micrometry 8. Viable count: Spread plate method 9. Viable count : Pour plate method 10. Study of Growth curve (Demonstration) 11. Study of effect of pH and temperature on growth Student activity: Preparation of biofilm and staining	
Unit-III	12. Wine production from grapes / Bread making 13. Study of microorganisms in fermented food by Gram Stain (curd or idli batter) Student activity: Study the effect of biofertilizer on plant growth. Demonstrating separation of DNA using Gel electrophoresis using videos. Demonstration of use of restriction enzymes in genetic engineering using animations.	
	Visit to a Industry (Food/ Dairy/ Pharma)	

REFERENCES:

Semester I Paper I

- Willey, J. M.; &Woolverton, C. J. (2008). Prescott, Harley &Kleins Microbiology 9th edition. Singapore: McGraw Hill International edition.
- Stanier, R. Y.; Ingraham, J. L.; Wheelis, M. L. & Painter, R. P. (1992). General Microbiology 5th edition. Cornell university: Macmillan, Hampshire & London.
- PelczarJr, M. J.; Chan, E.C.S. & Krieg, N. R. (1986). Microbiology 5th edition. New York:Tata McGraw-Hill Education Pvt. Ltd.
- Madigan, M. T.; Martinko, J. M.; Dunlap, P. V. & Clark, D. P. (2008). Brock Biology of Microorganisms. San Francisco: Pearson International edition.
- Nelson, D. L. & Cox, M. M. (2012). Lehninger Principles of Biochemistry 6th Edition.W.H. Freeman.

Semester II Paper I

- Willey, J. M. &Woolverton, C. J. (2008). Prescott, Harley &Kleins Microbiology 9th edition. Singapore: McGraw Hill International edition.
- PelczarJr, M. J.; Chan, E.C.S. & Krieg, N. R. (1986). Microbiology 5th edition. New York:Tata McGraw-Hill Education Pvt. Ltd.
- Stanier, R. Y.; Ingraham, J. L.; Wheelis, M. L. & Painter, R. P. (1992). General Microbiology 5th edition. Cornell university: Macmillan, Hampshire & London.

- Madigan, M. T.; Martinko, J. M.; Dunlap, P. V. & Clark, D. P. (2008). Brock Biology of Microorganisms. San Francisco: Pearson International edition.
- Tortora G.J., Funke, B.R., Case, C.L., 2016 Microbiology: an introduction. 11th edition. Pearson India ltd.
- Stanier, R. Y.; Ingraham, J. L.; Wheelis, M. L. & Painter, R. P. (1992). General Microbiology 5th edition. Cornell university: Macmillan, Hampshire & London.
- Cowan, M. K. & Smith, H. Microbiology fundamentals- A Clinical Approach, 3rd edition. United States: McGraw Hill publication.
- Collins, C. H. & Lyne, P. M. (2001). Collins & Lyne Microbiological methods, 7th edition. London: ARNOLD.

Semester I Paper II

- Black J. G., Black L. J. 2015 Microbiology: Principles and Explorations, 9th Edition J Wiley publishers
- Willey, J.M., Sherwood, L.M., Woolverton, C.J. 2015. Prescott's Microbiology, 9th International edition, McGraw Hill publication.
- Tortora G.J., Funke, B.R., Case, C.L., 2016 Microbiology: an introduction. 11th edition. Pearson India ltd.
- Kumar S. 2012 Textbook of Microbiology First Edition New Delhi: Jaypee Brothers Medical Publishers.
- Basic Practical Microbiology – A Manual. 2006 editors: Dariel Burdass, John Grainger & Janet Hurst published by the Society for General Microbiology retrieved from www.microbiologyonline.org.uk
- Becton, Dickinson and Co. 2009. Difco and BBL Manual of Microbiological Culture Media Second Edition Editors: Mary Jo Zimbro, David A. Power, Sharon M. Miller, George E. Wilson, Julie A. Johnson, published by

Semester II Paper II

- Willey, J.M., Sherwood, L.M., Woolverton, C.J. 2015. Prescott's Microbiology, 9th International edition, McGraw Hill publication.
- Tortora G.J., Funke, B.R., Case, C.L., 2016 Microbiology: an introduction. 11th edition. Pearson India Ltd.
- Madigan M. T., Martinko, J. M., Bender K. S., Buckley, D H., Stahl D. A., 2015 Brock Biology of Microorganisms 14th global edition: Pearson edu ltd.
- Stanier, Ingraham et al. 1986. General Microbiology. 5th edition, Macmillan education limited.
- Talaro, K. P., Chess K. 2012. Foundations in Microbiology 8th International edition, New York: McGraw Hill.
- Pelczar M., Chan E.C, Krieg N. R., 1993. Microbiology- Concepts and Applications, International edn, McGraw Hill
- Plummer D. 2004. An Introduction to Practical Biochemistry 3rd Indian edition. Tata McGraw-Hill.

Overall Examination and Marks Distribution Pattern

Semester I

Course	Paper I			Paper II			Grand Total
	IA	SEE	Total	IA	SEE	Total	
Theory	25	75	100	25	75	100	200
Practicals	-	50	50	-	50	50	100

Semester II

Course	Paper I			Paper II			Grand Total
	IA	SEE	Total	IA	SEE	Total	
Theory	25	75	100	25	75	100	200
Practicals	-	50	50	-	50	50	100

- **IA- Internal Assessment test; SEE – Semester End Examination**

MODALITY OF ASSESSMENT

Theory Examination Pattern:

A) Internal Assessment - 25 Marks.

One Periodical Class Test+ Active Participation / Attendance 25

MarksDuration- One Periodical class test- **1 Hr** duration; Active Participation/ attendance- entire Semester

Sr No	Particulars	Marks
A	Paper pattern for test	20 marks
Q.1	Objective (MCQ/Fill In The Blank/Name/Examples/Give One Word For/ Match the column)	5
Q.2	Define/explain /Answer in one line	5
Q.3	Short note/ Discuss/Describe/Justify	10
B	Attendance in routine class instructional deliveries	05 Marks

B) Semester End Examination - 75 Marks

Duration - These examinations shall be of **2.5 Hour** duration.

- Theory question paper pattern :-
 - There shall be **four** questions. One each of **20** Marks on the three units and fourth unit with **15** Marks will have questions based on all the three units.

PRACTICAL EXAMINATION PATTERN

(A)Internal Assessment:-

There will not be any internal examination/evaluation for practicals.

**(B) Semester End practical examination):- 50 Marks Per Section
(Section-I based on paper 1& Section-II based on paper 2)
SBSMCBP1**

Sr.No.	Particulars	Marks	Total
1.	Laboratory work (Section-I + Section-II)	30 + 40 =	70
2.	Journal	05 + 05 =	10
3.	Viva	05 + 05 =	10
4.	Quiz	10+00 =	10

SBSMCBP1 - Semester –I: (PRACTICAL EXAMINATION PATTERN)

	SECTION -I	Marks
TECHNIQUE	List the heads in practical as shown below	Marks assigned for each head
1	Special staining	20
2	Wet mount of Fungi	10
	Quiz	10
	Journal	5
	Viva	5
	TOTAL	50
	SECTION-II	
1	Gram staining	15
2	Isolation	10
3	Technique (effect of environment on growth of bacteria)	15
	Journal	5
	Viva	05
	TOTAL	50

SBSMCBP2

Sr. No.	Particulars	Marks	Total
1.	Laboratory work (Section-I + Section-II)	35 + 35 =	70
2.	Journal	05 + 05 =	10
3.	Viva	05 + 05 =	10
4.	Quiz	05 + 05 =	10

SBSMCBP2 - Semester –II: (PRACTICAL EXAMINATION PATTERN)

	SECTION -I	Marks
TECHNIQUE		
1	Viable Count	20
2	Minor technique (DMC, Heamocytometer, Opacity tubes, verification of Beer's law, etc.)	15
	Quiz	5
	Journal	5
	Viva	5
	TOTAL	50
	SECTION-II	
1	Major technique (Normal flora, Study of Rhizobia, Study of Azotobacter, etc.)	20
2	Study of invasive factors	15
	Quiz	5
	Journal	5
	Viva	5
	TOTAL	50