John Wilson Education Society's

Wilson College (Autonomous)

Chowpatty, Mumbai-400007
RE-ACCREDITED 'A' grade by NAAC

Affiliated to the
UNIVERSITY OF MUMBAI

Syllabus for F.Y

Program: B.Sc.

Program Code: WUSMIC (MICROBIOLOGY)

Choice Based Credit System (CBCS) with effect from Academic year 2023–2024

Based on the National Education Policy 2020

PROGRAM OUTLINE 2023-2024

YEAR	SEM	COURSE CODE		COURSE TITLE	CREDITS
FY	I	WSMICMJ111 / WSM MN111	Discipline specific course (DSC: Mandatory) (Major & Minor) Theory	Understanding History, scope of microbiology and Study of Prokaryotic cell structure.	2
		WSMICMJ112/ WSMICMN112	Discipline specific course (DSC: Mandatory) (Major & Minor) Theory	Introduction to Microbial Life	2
		WSMICMJ111/ WSMICMN113	Discipline specific course (DSC: Mandatory) (Major & Minor) Practical	Basic techniques in Microbiology	2
		WSMICOE111	Inter-disciplinary Generic/Open Elective: (OE)	Introduction and Scope of Microbiology	2
		WSMICSE111	Skill Enhancement Course (SEC)	Techniques and Biosafety processes in Diagnostic Laboratory	2
	II	WSMICMJ121/ WSMICMN121	Discipline specific course (DSC: Mandatory) (Major & Minor) Theory	Study of Eukaryotic microorganisms	2
		WSMICMJ122/ WSMICMN122	Discipline specific course (DSC: Mandatory) (Major & Minor) Theory	Microbial growth and nutrition	2
		WSMICMJ123/ WSMICMN123	Discipline specific course (DSC: Mandatory) (Major & Minor) Practical	Cultivation and Measurement of microbial growth	2

		WSMICOE121	**Inter-disciplinary Generic/Open Elective: (OE)**	**Microbes in everyday life**	**2**
		WSMICSE121	**Skill Enhancement Course (SEC)**	**Introduction to Clinical Microbiology Techniques**	**2**

PROGRAMME SPECIFIC OUTCOME (PSOs)

The Microbiology graduates shall:

PSO1 Study how microbes help us to understand our world and our place within it. It gives us insights into the complexity of nature and society, which in turn provide many different health, environmental, social, cultural, industrial and economic benefits.

PSO2 Apply fundamental knowledge of Microbiology to fields like environment, food and pharmaceutical industry, genetics, biochemistry, molecular biology, virology, immunology, medical and biotechnology. To expose students to the field of microbiology and other allied life science subjects and prepare them for promising career options in research, industries and academics.

PSO3 Exhibit qualitative and quantitative analytical skills in laboratory techniques such as staining, microscopy, asepsis, isolation, cultivation, enumeration, preservation and safe disposal of bacterial cultures which will help them to become well trained microbiologists in research laboratories and allied industries.

PSO4 Understand the working and handling of different instruments like microscope, sterilizing equipment, electronic weighing balance, colorimeter, pH meter, centrifuge, laminar air flow, handling of micropipettes and in silico tools to be used in research and industry.

PSO5 Acquire lifelong abilities like problem solving, logical reasoning, interpretation, analysis and documentation of data

PREAMBLE:

With the implementation of National Education Policy 2020 from the academic year 2023-24 and introduction of Choice Based Credit System (CBCS), the existing syllabus of F.Y.B.Sc. Microbiology is restructured to suit the NEP pattern for its implementation from 2023-24. While earlier revision of the syllabus took care of balancing both the basic techniques and some of the advanced techniques (as remaining will be introduced phase wise at S.Y.B.Sc. and T.Y.B.Sc level) in Microbiology. The concepts of Biosafety, Validation, Calibration and SOPs have been now introduced in the revised syllabus to make the learners aware about:-

i. The biological hazards and safety measures

ii. The significance of epidemiology in public health in addition to interaction of microbes and human health

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, whereas 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

PROGRAM: F.Y.B.Sc.	**SEMESTER: I (DSC: Major & Minor)**		
Course: **Understanding History, scope of microbiology and Study of Prokaryotic cell structure.**	**Course Code: WSMICMJ111 / WSMICMN111**		
Teaching Scheme			**Evaluation Scheme**
Lectures (Hours per week)	**Credit**	**Continuous Internal Assessment (CIA) (40%)**	**Semester End Examination (60%)**
2	**2**	**40**	**60**

Learning Objectives:
The course will enable the learners:
LO1:To learn the history of microbiology and the various contributions of scientists to the field of microbiology
LO2:To gain knowledge about the branches and scope of microbiology as a science.
LO3:To appreciate the role of biomolecules play as chemical basis of life
LO4: To explore the diversity among microbes based on size, shape and other structural characteristics.
LO4:To understand the structure and functions of prokaryotic cell components.

Course Outcomes:
At the end of the course, the students will be able to :
CO1: State the significant historical events in Microbiology.
CO2: Name and define the areas included in microbiological studies
CO3: Describe functional groups and biochemical interactions present in biomolecules.
CO4: Describe the structure and function of each component of a bacterial cell.
CO5: Distinguish between gram negative and gram-positive bacteria

DETAILED SYLLABUS

Course Code: WSMICMJ111 / WSMICMN111 Unit	**Subunit**	**Course/ Unit Title: Understanding History, scope of microbiology and Study of Prokaryotic cell structure.**	**Credits/ Lectures 2**
I		**History, Introduction and Scope Of Microbiology and Introduction to Chemical basis of life**	**15 lectures**
	1.1	**History, Introduction and Scope of Microbiology**	
	1.1.1	Evolution of microbial life.	
	1.1.2	The tree of life	
	1.1.3	Discovery of microorganisms	
	1.1.4	Types of microorganisms	
	1.1.5	History of microbiology	
	1.1.6	Important contributions of scientists to the field of Microbiology (Tabular) need to be updated	
	1.1.7	Introduction to fields of microbiology	
	1.2	**Introduction to Chemical basis of life**	
	1.2.1	Biomolecules as compounds of carbon with a variety of functional groups	
	1.2.2	Universal set of small molecules	
	1.2.3	Macromolecules as the major constituents of cells.	
	1.2.4	Water- Structure, properties in brief.	
	1.2.5	Carbohydrates- Definition, and classification	
	1.2.6	Proteins- Amino acid structure and classification	
	1.2.7	Lipids- Structure and classification	

	1.2.8	Nucleotides- Structure of purine and pyrimidine bases and classification.	
II		**Prokaryotic cell structure, function and Reproduction**	**15 lectures**
	2.1	The bacterial cell wall	
	2.2	Prokaryotic cell membranes a. The Fluid Mosaic Model of Membrane Structure b. Bacterial Membranes	
	2.3	Components external to cell wall-Capsule, Slime layer,	
	2.4	Flagella, Pili, Fimbriae	
	2.5	Cytoplasmic matrix-Inclusion bodies, magnetosomes, ribosomes, gas vesicles	
	2.6	Nucleoid, Plasmids	
	2.7	Bacterial endospores and their formation	
	2.8	Reproduction in prokaryotes	

References:

1. Willey, Joanne M, Linda Sherwood, Christopher J. Woolverton, and Lansing M. Prescott (2008) Prescott, Harley, and Klein's Microbiology. 7th edition. McGraw-Hill Higher Education, New York.
2. Michael T. Madigan, J. M. Martinko, David A. Stahl and David P. Clark (2012), Brock Biology of Microorganisms. 13th edition. Pearson Education, Inc., publishing as Benjamin Cummings.
3. David L. Nelson and Michael M. Cox (2005). Lehninger Principles of Biochemistry. 4th Ed., W.H. Freeman and Company, New York.
4. Gerard J. Tortora, Berdell R. Funke and Christine L. Case (2010). Microbiology and Introduction. 10th Edition. Pearson Benjamin Cummings.
5. M. J. Pelczar, C. S. Chane and R. K. Noel, (1993). Microbiology, 5th Edition, McGraw-Hill Publishing Company, New Delhi.
6. White, D. (1995). The Physiology and Biochemistry of Prokaryotes, 3rd edition, Oxford University Press
7. Stanier, R. Y., Ingraham J.L., Wheelis M.L. and Painter P. R. (1987) General Microbiology, 5th edition, The Macmillan press Ltd.

PROGRAM: F.Y.B.Sc.	**SEMESTER: I (DSC: Major & Minor)**		
Course: **Introduction to Microbial Life**	**Course Code: WSMICMJ112 / WSMICMN112**		
Teaching Scheme			**Evaluation Scheme**
Lectures (Hours per week)	**Credit**	**Continuous Internal Assessment (CIA) (40%)**	**Semester End Examination (60%)**
2	**2**	**40**	**60**

Learning Objectives:
The course will enable the learners:
LO1:To study various groups and types of microorganisms, their characteristics, mode of reproduction, habitat and significance.
LO2: To explore the diversity among microbes and appreciate their novelty.
LO3:To summarise different microbial interactions among themselves and their environments.
LO4: To understand the microbial interactions with plants, animals and other microorganisms

Course Outcomes:
At the end of the course, the students will be able to:
CO1 Write about the salient features of the various groups of microorganisms
CO2 Explain the differences of each type of microbe and discuss their applications
CO3 Summarise bacterial interactions with different ecosystems.
CO4 Discuss the effect of microbiota on human health.
CO5 Describe the various associations of microbes with plants.

DETAILED SYLLABUS

Course Code: WSMICMJ112 / WSMICMN112 Unit	**Subunit**	**Course/ Unit Title: Introduction to Microbial Life**	**Credits/ Lectures 2**
I		**Study of Viruses, Rickettsia, Chlamydia, Actinomycetes and Archaebacteria.**	**15 lectures**
	1.1	Viruses : Introduction, General properties of animal, plant and bacterial viruses and differences between them (tabulate with examples and their significance), classification of viruses.	
	1.2	Prions and Viroids	
	1.3	Rickettsia: General characteristic. Diseases and vector (tabular form)	
	1.4	Chlamydia: General characteristics and diseases (tabular form)	
	1.5	Mycoplasma: Properties and growth	
	1.6	Actinomycetes- Streptomyces- ecology, isolation and examples of antibiotics.	
	1.7	Cyanobacteria: Properties, significance and examples.	
	1.8	Archaea: Archaea cell wall, lipids and membranes. Characteristics of the major Archeal groups (tabular form)	
II		**Microbial Interactions**	**15 lectures**
	2.1	Types of Microbial Interactions:(with examples). Mutualism, Cooperation, Commensalisms, Predation Parasitism, Amensalism and Competition	
	2.2	Human Microbe Interactions:	
	2.2.1	Normal flora of the human body: Skin, Nose & Nasopharynx, Oropharynx, Respiratory tract, Eye, External ear, Mouth, Stomach, Small intestine, Large intestine, Genitourinary tract	
	2.2.2	Relationship between microbiota & the host	

	2.2.3	Gnotobiotic animals	
	2.3	Microbial associations with vascular plants:	
	2.3.1	Phyllosphere	
	2.3.2	Rhizosphere & Rhizoplane	
	2.3.3	Mycorrhizae	
	2.3.4	Nitrogen fixation: Rhizobia, Actinorhizae, Stem Nodulating rhizobia	
	2.3.5	Fungal & Bacterial endophytes	
	2.3.6	*Agrobacterium* & other plant pathogens	

References:

1. Willey, Joanne M, Linda Sherwood, Christopher J. Woolverton, and Lansing M. Prescott(2008) Prescott, Harley, and Klein's Microbiology. 7th edition. McGraw-Hill Higher Education,New York.

2. Michael T. Madigan, J. M. Martinko, David A. Stahl and David P. Clark (2012), Brock Biology of Microorganisms. 13th edition. Pearson Education, Inc., publishing as Benjamin Cummings.

3. M. J. Pelczar, C. S. Chane and R. K. Noel, (1993). Microbiology, 5th Edition, McGraw-Hill Publishing Company, New Delhi.

4. Gerard J. Tortora, Berdell R. Funke and Christine L. Case (2010). Microbiology An Introduction. 10th Edition. Pearson Benjamin Cummings.

5. Patricia M. Tille (2017). Bailey and Scott’s Diagnostic Microbiology, 14th edition, Elsevier.

PROGRAM: F.Y.B.Sc.	**SEMESTER: I (DSC: Major & Minor)**		
Course: **Basic techniques in Microbiology**	**Course Code: WSMICMJ113 / WSMICMN113**		
Teaching Scheme			**Evaluation Scheme**
Practical (Hours per week)	**Credit**	**Continuous Internal Assessment (CIA) (40%)**	**Semester End Examination (60%)**
4	**2**	**40**	**60**

Learning Objectives:

The course will enable the learners:

LO1: To learn the techniques involved in culturing microorganism, including preparation and sterilization of culture media and isolation of pure cultures by aseptic techniques using the streaking method

LO2: To demonstrate the growth and control of microbes using physical and chemical means

LO3: To develop skills in different bacteriological techniques involved in microbiology.

LO4: To demonstrate competence in staining and identification of microorganisms

LO5:Define the goal of aseptic technique and how it can benefit research

Course Outcomes:

At the end of the course, the students will be able to :

CO1:List the common sources of experimental contamination

CO2: Differentiate between disinfectants, antiseptics, and sterilants

CO3: Describe the principles of controlling the presence of microorganisms through sterilization and disinfection

CO4: Identify the major parts and functions of the microscope.

CO5: Calculate the total magnification for each of the lenses of the microscope.

CO6 : Explain resolving power, parfocal, working distance, size and depth of viewing field

CO7: Demonstrate the correct use of microscope in visualization of microorganisms

CO8: Select the right procedure of staining microbes

CO9 : Practice preparation of smear for staining.

CO10: Explain the effect of various physical and chemical agents on growth of microbes.

CO11: Evaluating the effects of various antibiotics and chemotherapeutic agents on microbes

CO12: Report observations and findings.

DETAILED SYLLABUS

Course Code: WSMICMJ113/ WSMICMN113		**Course/ Unit Title: Basic techniques in Microbiology**	**Credits**
		Practicals	**2**
	1	To study parts and functions of the Compound microscope.	
	2	To study the instrumentation and working of dark field microscope, Phase Contrast Microscope, Fluorescence Microscope using virtual laboratory	
	3	To study different types of staining methods: 1. Preparation and processing of smear 2. Observation of morphology and arrangement of different microorganisms by positive staining (eg. monochrome staining) and negative staining. 3. Differential staining: Gram staining.	
	4	Special staining methods to study specific structures: Cell wall, Capsule, Lipid, Metachromatic granules, Spore, flagella	
	5	To observe motility by hanging drop technique	
	6	Handling of glasswares used in microbiology laboratory	
	7	Preparation of Culture Media: a. Liquid medium (Nutrient Broth) b. Solid Media (Nutrient agar, Sabouraud's agar) c. Preparation of slant, butts & plates	
	8	Inoculation techniques and Study of different growth pattern: a. Inoculation of Liquid Medium b. Inoculation of Solid Media (Slants, Butts and Plates)	
	9	Study of physical methods of microbial control: 1.Effect of Moist Heat: Study of Autoclave (Demo) 2.Fractional Sterilization: Inspissator (Demo) 3.Effect of Dry Heat: Hot Air Oven (Demo) 4.Effect of Low Temperature: microbiostatic: Refrigeration 5.Effect of UV Light 6.Effect of Desiccation 7.Effect of Osmotic Pressure	

	10	Chemical methods of Microbial Control: 1. Effect of dyes (disc diffusion method) 2. Phenolic compounds (theory) 3. Chemotherapeutic agents: eg Antibiotics (disc diffusion method) 4. Heavy metals (Oligodynamic action)	

PROGRAM: F.Y.B.Sc.	**SEMESTER: I (OE: Interdisciplinary General Elective)**	
Course: **Introduction and Scope of Microbiology**	**Course Code: WSMICOE111**	
Teaching Scheme		**Evaluation Scheme**
Lectures **(Hours per week)**	**Credit**	**Sem End Examination**
2	**2**	**60 Marks**

Learning Objectives:
The course will enable the learners to:
LO1: Gain basis knowledge on the subject of microbiology
LO2: Comprehend the contributions of scientists to the field of microbiology
LO3: Conceptualize things that are too small to see, and learn the range of sizes in the microscopic world
LO4: Acknowledge the diversity in the microbial world
LO4: Understand the profound role microbes play in cycling of elements in nature
LO5: Appreciate the role of microbes in different walks of life.
LO6: Explore the influence of microbes that impact our health and their role in our lives

Course Outcomes:
At the end of the course, the students will be able to:
CO1: Create scale models of microorganisms, compare their relative sizes.
CO2: State the key roles microbes play in nutrient cycling, biodegradation/biodeterioration, climate change, food spoilage, the cause and control of disease
CO3: Describe characteristic faetures of type of microbes
CO4: Enlist examples of different types of cellular and viral microorganisms and infectious agents
CO5: Describe how different microbes function to gain energy and recycle nutrients in nature
CO7: Discuss the "Good" and “bad” aspects of microbes and the impacts of microbes on ecosystems and on our globe.

DETAILED SYLLABUS

Course Code/ WSMICOE111 Unit	Subunit	Course/ Unit Title: Introduction and Scope of Microbiology	Credits/ Lectures 2
I		**The Main Themes of Microbiology**	**15 lectures**
	1.1	The Historical Foundations of Microbiology	
	1.2	Dimensions: How Small Is Small?	
	1.3	Basic structure of cells and viruses.	
	1.4	General Characteristics of Microorganisms and their significance	
	1.5	The Scope of Microbiology and Branches of Microbiology (tabulated)	
II		**Involvement of microbes**	**15 lectures**
	2.1	In Energy and Nutrient Flow.	
	2.2	For human use	
	2.3	In Infectious Diseases	
	2.4	In development of Medical Microbiology	

References:

1. Willey, Joanne M, Linda Sherwood, Christopher J. Woolverton, and Lansing M. Prescott (2008) Prescott, Harley, and Klein's Microbiology. 7th edition. McGraw-Hill Higher Education,New York.
2. Michael T. Madigan, J. M. Martinko, David A. Stahl and David P. Clark (2012), Brock Biology of Microorganisms. 13th edition. Pearson Education, Inc., publishing as Benjamin Cummings.
3. M. J. Pelczar, C. S. Chane and R. K. Noel, (1993). Microbiology, 5th Edition, McGraw-Hill Publishing Company, New Delhi.
4. Gerard J. Tortora, Berdell R. Funke and Christine L. Case (2010). Microbiology An Introduction. 10th Edition. Pearson Benjamin Cummings.
5. Patricia M. Tille (2017). Bailey and Scott’s Diagnostic Microbiology, 14th edition, Elsevier.
6. L. Veerakumari (2006). Bioinstrumentation. MJP Publishers.
7. Barry Chess and Kathleen Park Talaro, (2014). Talaro's Foundations in Microbiology. 9th Edition. McGraw-Hill Higher Education,New York.

PROGRAM: F.Y.B.Sc.	**SEMESTER: I (SEC: Skill Enhancement Course)**	
Course: **Introduction to Basic Laboratory Techniques and Biosafety processes in Diagnostic**	**Course Code: WSMICSE111**	
Teaching Scheme		**Evaluation Scheme**
Praticals (Hours per week)	**Credit**	**Semester End Examination**
4	**2**	**60 marks**

Learning Objectives:
The course will enable the learners to :
LO1: Operate the routinely used laboratory instruments.
LO2: Learn to write SOP for laboratory instruments.
LO3: Use micropipette effectively
LO4: Perform Quality control procedures for equipment.
LO5: Prepare reagents to be used in routine laboratory work .

Course Outcomes:
At the end of the course, the students will be able to :
CO1:Demonstrate the calibration of graduated pipettes
CO2:Illustrate the use of micropipettes for accurately dispensing small volumes of liquid
CO3:Write the Standard operating procedure of routine laboratory instruments
CO4: Calculate the normality, molality etc for preparation of reagents
CO5: Explain the principle and working of basic laboratory instruments.

DETAILED SYLLABUS

Course Code: WSMICSE111 Unit		**Course/ Unit Title: Introduction to Basic Laboratory Techniques and Biosafety processes in Diagnostic**	**Credits 2**
		Practicals	
	1	Handling of micro- pipettes and calibration of graduated pipettes	
	2	To study different types of equipments and instruments: a) pH meters b) Centrifuges c) Weighing balances d) Biosafety cabinets e) Colorimeter	
	3	Writing of Standard Operating Procedure (SOP) for Laboratory Instruments.	
	4	Quality Control of equipments and Instruments: a) Autoclave b) Incubator c) Hot air ovens d) Deep Freezer e) Refrigerator f) Colorimeter g) pH meter	
	5	To prepare various types of reagents. a. Concept of percent solutions, ppm, normality, molality (liquid and solid) etc b. Preparation of weight/volume and volume/volume solutions.	
	6	a.To study safety measures implemented in Laboratory: Chemical Safety Fire Safety Electrical Safety b. Exposure control plan: Employee education and orientation c. Disposal of Hazardous waste, Standard precautions, introduction to act on disposal of hazardous bio-waste d. Engineering controls: Laboratory Environment e. Biological Safety Cabinet f. Personal protective equipment, Post exposure prophylaxis and control	

MODALITY OF ASSESSMENT

Course	**DSC**	**DSC**	**DSC**	**OE**	**SEC**
	Theory	Theory	Practical	Theory	Theory
Name	Understanding History, scope of microbiology and Study of Prokaryotic cell structure.	Introduction to Microbial Life	Basic techniques in Microbiology	Introduction and Scope of Microbiology	Biosafety in the Microbiology laboratory
Code	**WSMICMJ111 / WSM MN111**	**WSMICMJ112/WSMICMN112**	**WSMICMJ111/ WSMICMN113**	**WSMICOE111**	**WSMICSE111**
Credit	2	2	2	2	2
CIA	40M	40M	40M	--	--
Sem End	60M	60M	60M	60	60M
Total	100	100	100	60M	60M

Examination Pattern: For Discipline specific courses

A. Internal Assessment- 40%- 40 Marks per paper

Sr. No.	Evaluation Type	Marks
1.	Written Objective Examination/Assignment/ Case study/ field visit report/ presentation/ project Multiple assignments may be given	40M
	Total	40M

B. External Examination- 60%- 60 Marks per paper

Semester End Theory Examination:

1. Duration - These examinations shall be of two hours duration.
2. Theory question paper pattern:

a. There shall be questions each of 20 marks based on two units and the third unit will be a mixed bag question .

b. All questions shall be compulsory with internal choice within the questions.

Paper Pattern:

Question	Options	Marks	Questions Based on
Describe /Explain/ Short notes /Answer the following	4 / 6	5 marks each - 20M	UNIT 1

Discuss / Short notes /Answer the following	4/6	5 marks each -20M	UNIT 2
Do as Directed: three sub questions Define/Explain/ Give egs,State true or false/Match the columns/Analogy/	10/12	1/ 2marks each-20M	UNIT 3

Practical Examination Pattern:

DSC: Basic techniques in Microbiology

A. Internal Examination: 40%- 40 Marks -Two CIA each of 20M

Particulars	**Marks**
Journal	5 marks
Experimental tasks /Assignment	10 marks
Participation	5 marks
Total	**20 marks**

B. External Examination: 60%- 60 Marks

Semester End Practical Examination:

Particulars	**Marks**
Laboratory work **Major Tech** **Minor Tech**	25 marks 15 marks
Spots/Quiz/	10 marks
Viva	10 marks
Total	**60 marks**

PRACTICAL BOOK/JOURNAL

The students are required to perform 75% of the Practical for the journal to be duly certified. 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.

Examination Pattern: Open Elective.

1. Two assignments of 30 marks each. (Oral Presentations/Written assignments/ Case studies)

Examination Pattern: Skill Enhancement Course:60M

Particulars	**Marks**
Technique 1	**10**
Technique 2	**10**
Technique 3/viva/spots	**10**
SOP writing	**10**
Problems on preparation of reagents	**10**
Journal	**10**

<table>
<tr><td colspan="2">PROGRAM: F.Y.B.Sc.</td><td colspan="2">SEMESTER: II (DSC: Major & Minor)</td></tr>
<tr><td colspan="2">Course:
Study of Eukaryotic microorganisms</td><td colspan="2">Course Code: WSMICMJ121 / WSMICMN121</td></tr>
<tr><td colspan="3">Teaching Scheme</td><td>Evaluation Scheme</td></tr>
<tr><td>Lectures (Hours per week)</td><td>Credit</td><td>Continuous Internal Assessment (CIA) (40%)</td><td>Semester End Examination (60%)</td></tr>
<tr><td>2</td><td>2</td><td>40</td><td>60</td></tr>
<tr><td colspan="4">Learning Objectives:
The course will enable the learners:
LO1: To understand the structural complexities in a typical eukaryotic cell.
LO2: To study the functions of organelles in the eukaryotic cell
LO3: To comprehend the salient features of various eukaryotic organsisms eg algae, protozoan and fungi and know their roles in environment.
LO4: To gain knowledge of the application of various eukaryotes.</td></tr>
<tr><td colspan="4">Course Outcomes:
At the end of the course, the students will be able to:
CO1: To sketch the different structures of an eukaryotic cell
CO2: To explain the concept of compartmentalization and its significance in eukaryotic cells.
CO3: To state and explain the various functions of each component of an eukaryotic cell.
CO4: To compare and contrast between prokaryotic and eukaryotic cell structures.
CO5: To discuss the salient features, structural characteristics, distribution, mode of reproduction, nutrition patterns and significance of organisms under fungus, algae and protozoa
CO6: To classify eukaryotes based on their observable characteristics</td></tr>
</table>

DETAILED SYLLABUS

Course Code: WSMICMJ121 / WSMICMN121/ Unit	**Subunit**	**Course/ Unit Title: Study of Eukaryotic microorganisms**	**Credits/ Lectures 2**
I		**Eukaryotic cell structure and Function**	**15 lectures**
	1.1	Overview of Eukaryotic cell structure and Function.	
	1.2	The cytoplasmic matrix, microfilaments, Intermediate filaments and microtubules	
	1.3	Endoplasmic reticulum and Golgi apparatus	
	1.4	Lysosomes and Endocytosis	
	1.5	Eukaryotic ribosomes, Mitochondria and Chloroplasts	
	1.6	Nucleus, Nucleolus, Cell division, Mitosis and Meiosis	
	1.7	External cell coverings	
	1.8	Comparison between Prokaryotic and Eukaryotic cell	
II		**Study of Fungi, Algae and Protozoa**	**15 lectures**
	2.1	Study of Fungi, Algae and Protozoa Classification, Morphological characteristics, cultivation, reproduction and significance: Fungi- Molds and Yeast	
	2.2	Classification, Morphological characteristics, cultivation, reproduction and significance: Algae	
	2.3	Classification, Morphological characteristics, cultivation, reproduction and significance: Protozoa	

References:

1. Willey, Joanne M, Linda Sherwood, Christopher J. Woolverton, and Lansing M. Prescott (2008) Prescott, Harley, and Klein's Microbiology. 7th edition. McGraw-Hill Higher Education, New York.
2. Gerard J. Tortora, Berdell R. Funke and Christine L. Case (2010). Microbiology an Introduction. 10th Edition. Pearson Benjamin Cummings.
3. M. J. Pelczar, C. S. Chane and R. K. Noel, (1993). Microbiology, 5th Edition, McGraw-Hill Publishing Company, New Delhi.
4. Stanier, R. Y., Ingraham J.L., Wheelis M.L. and Painter P. R. (1987) General Microbiology, 5th edition, The Macmillan press Ltd.

PROGRAM: F.Y.B.Sc.	**SEMESTER: II (DSC: Major & Minor)**		
Course: Microbial growth and nutrition	**Course Code: WSMICMJ122 / WSMICMN122**		
Teaching Scheme			**Evaluation Scheme**
Lectures (Hours per week)	**Credit**	**Continuous Internal Assessment (CIA) (40%)**	**Semester End Examination (60%)**
2	**2**	**40**	**60**

Learning Objectives:
The course will enable the learners:
LO1: To understand the nutritional requirements of various microbes
LO2: To appreciate the diversity in types of microbes based on nutritional needs
LO3: To introduce basic metabolism
LO4: To understand the concept of growth
LO5: To learn the patterns and phases of microbial growth
LO6: To study the influence of environment on growth
LO7:To learn the techniques for enumerating microbes

Course Outcomes:
At the end of the course, the students will be able to :
CO1: Enlist the different nutritional types in microbes
CO2: Describe the role of various elements and their significance in nutrition for microbes
CO3: Discuss the nutrient uptake mechanism in microorganisms
CO4: Classify microbes based on their nutritional needs
CO5: Differentiate/compare between types of growth pattern.
CO6: Summarise the various techniques used in enumeration of growth
CO7: Explain the influence of the environment on microbial growth.

DETAILED SYLLABUS

Course Code: WSMICMJ122 / WSMICMN122 Unit	**Subunit**	**Course/ Unit Title: Microbial growth and nutrition**	**Credits/ Lectures 2**
I		**Microbial Nutrition and introduction to metabolism**	**15 lectures**
	1.1	Nutritional requirements – Carbon, Oxygen, Hydrogen, Nitrogen, Phosphorus, Sulfur and growth factors.	
	1.2	Nutritional types of microorganisms	
	1.3	Nutrient uptake mechanisms	
	1.4	Introduction to metabolism.	
	1.4.1	Bioenergetics	
	1.4.2	Catalysis and Enzymes	
	1.4.3	Biological reactions: oxidation and reduction reactions	
	1.4.4	3 modes of metabolism:Fermentation, Respiration, Photosynthesis	
	1.4.5	Universal mechanisms for ATP generation: Substrate level, Oxidative and Photo	
II		**Microbial growth**	**15 lectures**
	2.1	Definition of growth, explanation of growth concept, calculation of mean growth rate and doubling time, Growth curve.	
	2.2	Synchronous growth, Continuous growth (Chemostat and Turbidostat)	
	2.3	Influence of environmental factors on growth, Quorum sensing techniques.	
	2.4	Microbial growth in the natural environment	
	2.5	Counting viable but non-culturable organisms.	

References:

1. Willey, Joanne M, Linda Sherwood, Christopher J. Woolverton, and Lansing M. Prescott(2008) Prescott, Harley, and Klein's Microbiology. 7th edition. McGraw-Hill Higher Education,New York.

2. Michael T. Madigan, J. M. Martinko, David A. Stahl and David P. Clark (2012), Brock Biology of Microorganisms. 13th edition. Pearson Education, Inc., publishing as Benjamin Cummings.

3. M. J. Pelczar, C. S. Chane and R. K. Noel, (1993). Microbiology, 5th Edition, McGraw-Hill Publishing Company, New Delhi.

4. Gerard J. Tortora, Berdell R. Funke and Christine L. Case (2010). Microbiology An Introduction. 10th Edition. Pearson Benjamin Cummings.

PROGRAM: F.Y.B.Sc.	**SEMESTER: II (DSC: Major & Minor)**		
Course: Cultivation and Measurement of microbial growth	**Course Code: WSMICMJ123 / WSMICMN123**		
Teaching Scheme			**Evaluation Scheme**
Practical (Hours per week)	**Credit**	**Continuous Internal Assessment (CIA) (40%)**	**Semester End Examination (60%)**
4	**2**	**40**	**60**

Learning Objectives:
The course will enable the learners:
LO1: To practise the different methods for isolation of pure culture
LO2: To understand the principles and method of preparation of media in microbiological work
LO3: To learn the various methods of cultivation of Anaerobic bacteria
LO4: To enumerate the microorganism using direct microscopic techniques, Mcfarlands Standards, viable count etc
LO5: To study the principle of preservation of microbial cultures.

Course Outcomes:
At the end of the course, the students will be able to :
CO1 : Use techniques for isolation of pure cultures.
CO2: Explain methods for sterilizing materials.
CO3: Explain procedures for making serial dilutions.
CO4: Perform serial dilution for plating and counting viable cells.
CO5: Demonstrate the use of a colony counter.
CO6: Demonstrate the use of spectrophotometer to measure bacterial growth.
CO7: Demonstrate the use of selective, differential and enrichment media.

DETAILED SYLLABUS

Course Code: WSMICMJ123 / WSMICMN123		**Course/ Unit Title: Cultivation and Measurement of microbial growth**	**Credits 2**
		Practicals	
	1	Study of different types of culture media: 1. Enriched and differential medium: SIBA 2. Selective and Differential medium-MacConkey's medium 3. Enrichment medium: Nitrogen free Ashby's Mannitol broth.	
	2	To study pure culture techniques 1. Streak plate method 2. Spread plate method 3. Colony characteristics	
	3	Cultivation of Anaerobic microorganisms 1. Collection of sample eg. cow dung and horse dung and its processing 2. Enrichment using media:Robertson Cooked Meat medium, Differential Reinforced Clostridial Medium, Fluid Thioglycolate medium 3. Observation of Anaerobic spore bearers using gram staining method 4. Study of anaerobic jar and GasPak system (Demo) 5. Anaerobic work station (Demo)	
	4	Methods of maintenance and Preservation of bacterial cultures: 1. Periodic transfer to fresh media 2. Mineral oil overlay technique 3. soil stock 4. lyophilization (Demo) 5. preservation at low temperature. (liq N2)	
	5	Study of different methods of measurement of growth: 1. Total Count a. Direct microscopic methods: 1. Breed's count 2. Haemocytometer. b. Viable count by – 1. Spread plate technique 2. Pour plate technique 2. Turbidity measurements 1. McFarland Standards 2. Spectrophotometer technique.	

		3. Determination of wet and dry weight.	
	6	Cultivation of Fungi 1. Isolation of yeasts on solid medium 2. Slide Culture technique 3. Fungal Wet mounts & Study of Morphological Characteristics: *Mucor, Aspergillus.*	
	7	Permanent slides of Algae, Protozoa	
	8	Microscopic study of hay infusion to observe microflora by wet mount method.	

PROGRAM: F.Y.B.Sc.	**SEMESTER: II (OE: Interdisciplinary General Elective)**	
Course: **Microbes in everyday life**	**Course Code: WSMICOE121**	
Teaching Scheme		**Evaluation Scheme**
Lectures (Hours per week)	**Credit**	**Semester End Examination**
2	**2**	**60 marks**

Learning Objectives:
The course will enable the learners:
LO1: To appreciate and acknowledge the role microbes play in human health, food spoilage and biowarfare.
LO2: To understand the basic terminologies used in Medical microbiology, Epidemiology and food microbiology.
LO3: To study the basics of disease transmission and progression and precautions to be taken for global travel.
LO4: To gain knowledge on the basic aspect of controlling spoilage of food.
LO5: To study the process of fermentation with suitable examples.

Course Outcomes:
At the end of the course, the students will be able to :
At the end of the course, the students will be able to :
CO1: Enlist the preventive measures during epidemic and global travel
CO1: Describe the benefits (physiological and psychological) of microbiota on the human body.
CO2: Define the various terminologies in Medical microbiology, Epidemiology and food microbiology.
CO3: Comprehend/illustrate the basis of fermentation technology
CO4: Explain the modes of transmission of pathogens and disease progression
CO5: Summarise the role of microbes in food spoilage and methods of control of food spoilage

DETAILED SYLLABUS

Course Code: WSMICOE121 Unit	**Subunit**	**Course/ Unit Title: Microbes in everyday life**	**Credits/ Lectures 2**
I		**Role of microbes in human health**	**15 lectures**
	1.1	Significance of Microbiome with special reference to Gut Microbiota'	
	1.2	Difference between infection & disease. (Important terminology: Primary infection, secondary infection. Contagious infection, occupational disorder, clinical infection, subclinical infection, Zoonoses, genetic disorder, vector borne infection)	
	1.3	The Infectious Disease Cycle: Story of a Disease And How Was the Pathogen Transmitted?	
	1.4	Emerging and Re-emerging Infectious Diseases and Pathogens	
	1.5	Control of Epidemics and Global Travel and Health Considerations	
	1.6	Bioterrorism Preparedness	
II		**Role of microbes in food**	**15 lectures**
	2.1	Food as a nutritive medium for growth of microorganisms	
	2.2	a. Food Spoilage. 1. Food Borne Diseases: Infection and food poisoning (case studies) 2. Controlling Food Spoilage	
	2.3	b. Microbiology of Fermented Foods (Fermented Milks, Probiotics, Cheese Production, Meat and Fish, Production of Alcoholic Beverages, Production of Breads.)	
	2.4	Microorganisms as Foods and Food Amendments (Mushroom)	

References:

1. Willey, Joanne M, Linda Sherwood, Christopher J. Woolverton, and Lansing M. Prescott (2008) Prescott, Harley, and Klein's Microbiology. 7th edition. McGraw-Hill Higher Education,New York.
2. Michael T. Madigan, J. M. Martinko, David A. Stahl and David P. Clark (2012),

Brock Biology of Microorganisms. 13th edition. Pearson Education, Inc., publishing as Benjamin Cummings.
3. M. J. Pelczar, C. S. Chane and R. K. Noel, (1993). Microbiology, 5th Edition, McGraw-Hill Publishing Company, New Delhi.
4. Gerard J. Tortora, Berdell R. Funke and Christine L. Case (2010). Microbiology An Introduction. 10th Edition. Pearson Benjamin Cummings.
5. Patricia M. Tille (2017). Bailey and Scott's Diagnostic Microbiology, 14th edition, Elsevier.
6. L. Veerakumari (2006). Bioinstrumentation. MJP Publishers.
7. Barry Chess and Kathleen Park Talaro, (2014). Talaro's Foundations in Microbiology. 9th Edition. McGraw-Hill Higher Education,New York.
8. Kathleen Park Talaro and Arthur Talaro (2002). Foundations in Microbiology. 4th edition. International edition McGraw Hill.

PROGRAM: F.Y.B.Sc.	**SEMESTER: II (SEC: Skill Enhancement Course)**	
Course: **Introduction to Clinical Microbiology Techniques**	**Course Code: WSMICSE121**	
Teaching Scheme		**Evaluation Scheme**
Practicals (Hours per week)	**Credit**	**Semester End Examination**
4	**2**	**60 Marks**

Learning Objectives:
The learner will be able to:
LO1: Understand the processing and preparation of pathological samples
LO2: Gain knowledge of different blood groups and their significance in medical field
LO3: Study the principles of Antimicrobial sensitivity testing
LO3: Understand the use of hemocytometer for RBC and WBC count
LO4: Appreciate the significance of different hematological tests in the course
LO5: Study the basis of quality control of media and reagents.
LO6: Comprehend the process of Inventory management.

Course Outcomes:
CO1: Demonstrate Acid fast staining of sputum sample.
CO2: Perform the different hematology tests.
CO3: Enumerate RBC and WBC using hemocytometer.
CO4: Analyse the quality of media and reagents.
CO5:Interpret and report the observation and results.
CO6: Explain the process of Inventory management.

DETAILED SYLLABUS

Course Code: WSMICSE121		**Course/ Unit Title: Introduction to Clinical Microbiology Techniques**	**Credits 2**
		Practicals	
	1	Processing of sputum sample and observation of Acid-fast bacilli using ZNCF staining method	
	2	To perform Germ tube test	
	3	Determination of Antibacterial Sensitivity by E-Test	
	4	Determination of Blood group and Rh factor	
	5	Differential blood count	
	6	Total WBC count by Hemocytometer	
	7	Total RBC count by Hemocytometer	
	8	Platelet count	
	9	Measurement of hemoglobin content	
	10	Determination of Packed cell volume(Demo)	
	11	Determination of Erythrocyte Sedimentation Rate (ESR)	
	12	Drawing of blood from patient (Demo)	
	13	Quality Control of Culture Media: a) MacConkey Agar b) Salmonella-Shigella Agar c) Cetrimide Agar d) Biochemicals (Simmon's Citrate, 2% tryptone water, Urea broth, Glucose Phosphate Broth)	
	14	Processing of Pathological samples	
	15	Inventory Management	

MODALITY OF ASSESSMENT

Course	**DSC**	**DSC**	**DSC**	**OE**	**SEC**
	Theory	Theory	Practical	Theory	Theory
Name	Study of Eukaryotic microorganisms.	Microbial growth and nutrition	Cultivation and Measurement of microbial growth	Microbes in everyday life	Introduction to Clinical Microbiology Techniques
Code	**WSMICMJ121/ WSMICMN121**	**WSMICMJ122/WSMICMN122**	**WSMICMJ123/ WSMICMN123**	**WSMICOE121**	**WSMICSE121**
Credit	2	2	2	2	2
CIA	40M	40M	40M	--	--
Sem End	60M	60M	60M	60	60M
Total	100	100	100	60M	60M

Examination Pattern: For Discipline specific courses

Internal Assessment- 40%- 40 Marks per paper

Sr. No.	Evaluation Type	Marks
2.	Written Objective Examination/Assignment/ Case study/ field visit report/ presentation/ project Multiple assignments may be given	40M
	Total	40M

External Examination- 60%- 60 Marks per paper

Semester End Theory Examination:

1. Duration - These examinations shall be of two hours duration.
2. Theory question paper pattern:

a. There shall be questions each of 20 marks based on two units and the third unit will be a mixed bag question.

b. All questions shall be compulsory with internal choice within the questions.

Paper Pattern:

Question	Options	Marks	Questions Based on
Discuss / Short notes /Answer the following	4 / 6	5 marks each - 20M	UNIT 1
Discuss / Short notes /Answer the following	4/6	5 marks each -20M	UNIT 2

Do as Directed: three sub questions Define/Explain/ Give egs,State true or false/Match the columns/Analogy/	10/12	1/ 2 marks each-20M	UNIT 3

Practical Examination Pattern:

DSC: Cultivation and Measurement of microbial growth

A. Internal Examination: 40%- 40 Marks -Two CIA each of 20M

Particulars	Marks
Journal	5 marks
Experimental tasks /Assignment	10 marks
Participation	5 marks
Total	**20 marks**

B. External Examination: 60%- 60 Marks

Semester End Practical Examination:

Particulars	Marks
Laboratory work **Major Tech** **Minor Tech**	25 marks 15 marks
Spots/Quiz/	10 marks
Viva	10 marks
Total	**60 marks**

PRACTICAL BOOK/JOURNAL

The students are required to perform 75% of the Practical for the journal to be duly certified. 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.

Examination Pattern: Open Elective.

1. Two assignments of 30 marks each. (Oral Presentations/Written assignments/ Case studies)

Examination Pattern: Skill Enhancement Course: 60M

Particulars	Marks
Technique 1	**10**
Technique 2	**10**
Technique 3/viva/spots	**10**
SOP writing	**10**
Problems on preparation of reagents	**10**
Journal	**10**