JAI HIND COLLEGE

Basantsing Institute of Science & J. T. Lalvani College of Commerce
and Sheila Gopal Raheja College of Management.

Empowered Autonomous

"A" Road, Churchgate, Mumbai - 400 020, India

Affiliated to
University of Mumbai

Bachelor of Science

Program: B.Sc. in Microbiology

Choice Based Credit System (CBCS) under NEP-2020
with effect from the academic year 2023-2024

Syllabus as approved by Statutory Committees

LOCF Document

PRINCIPAL
JAI HIND COLLEGE
CHURCHGATE, MUMBAI-400 020

JAI HIND COLLEGE 'A' Road Churchgate Mumbai-20. AUTONOMOUS

CONTENTS

PREAMBLE

Microbiology is the study of microorganisms: simple life-forms that include bacteria, archaea, algae, fungi, protozoa, and viruses. The studies carried out on these microorganisms contribute greatly to the understanding of mechanisms in higher life forms. Microbes are present everywhere influencing the world of humans in monumental ways, ranging from infectious diseases to healthful living, and from food production to waste treatment. Today microbiology research has led to improved crop yields, bioremediation of pollutants, techniques to cure diseases, reduce food-borne illnesses, prevent infections, develop new products such as antibiotics, insulin, and many novel products. As quoted by the Microbiology Society "Microbiology research has been and continues to be, central to meeting many of the current global aspirations and challenges, such as maintaining food, water and energy security for a healthy population on a habitable earth." Microbiology research will also help to answer big questions such as 'how diverse is life on Earth?', and 'does life exist elsewhere in the Universe'?"

Discoveries carried out in this field in the last two decades have put Microbiology on the center stage of teaching, research and development all over the globe. Upon graduation in Microbiology learners will acquire the attributes of knowledge, skills, temperament and ethics related to the subject of Microbiology.

The learning outcome based curriculum framework for F.Y.B.Sc Microbiology is intended to provide a comprehensive foundation for the subject keeping in mind the ever-evolving nature of this subject. The syllabus aims at laying down a strong foundation of the basic concepts of Microbiology and at the same time expose the students to the latest discoveries in Microbiology and other interdisciplinary fields. The syllabus is directed at equipping the students with basic knowledge in various branches of Microbiology such as Microbial Genetics, Molecular Biology, Virology, Medical Microbiology, Immunology, Microbial Biochemistry and Industrial Microbiology. Additionally, it also makes students aware of interdisciplinary sciences such as Bioinformatics, Biostatistics and Bioinstrumentation. Research and creative thinking are the main focus and a compulsory component.

CREDIT FRAMEWORK

Types of Courses

Sr No	Type of Course	Learner Category
1	Major	Microbiology Major
2	Minor	Microbiology Minor
3	OE	Commerce/Arts Stream
4	SEC	Microbiology Major Microbiology Minor
5	VSC	Microbiology Major Microbiology Minor

Number of Courses and Credits

Type of Course	Number offered of each	Credits of each (Theory + Practical)
Major	2	4 (3+ 1)
Minor	2	4 (3+ 1)
VSC	2	2 (Practical)
SEC	2	2 (Practical)
OE	2	2 (Theory)

Semester-wise Courses

Semester	Course Codes	Course Title	Type	Credits
I	JUSMIC-DSC101	Foundation in Microbiology	Major	3
	JUSMIC-DSCPR101	Microbiology Practical I	Major	1
	JUSMIC-MIN101	Foundation in Microbiology	Minor	3
	JUSMIC-MIN PR101	Microbiology Practical I	Minor	1
	JUSMIC-VSC101	Introduction to Clinical Microbiology	VSC	2
	JUSMIC-SEC101	Fermentation Technology	SEC	2
	JUSMIC-OE101	Health and Hygiene	OE	2
II	JUSMIC-DSC-201	Microbial Metabolism and Genetics	Major	3
	JUSMIC-DSCPR201	Microbial Practical II	Major	1
	JUSMIC-MIN201	Microbial Metabolism and Genetics	Minor	3
	JUSMIC-MINPR201	Microbial Practical II	Minor	1
	JUSMIC-VSC201	Introduction to Clinical Microbiology	VSC	2
	JUSMIC-SEC201	Fermentation Technology	SEC	2
	JUSMIC-OE201	Health and Hygiene	OE	2
	JUSMIC-OE202	Diet Management	OE	2

LEARNING OUTCOME BASED APPROACH

The National Higher Education Qualifications Framework (NHEQF) envisages that students must possess the quality and characteristics of the graduate of a programme of study, including learning outcomes relating to the disciplinary area in the chosen field of learning and generic learning outcomes that are expected to be acquired by a graduate on completion of the programme of study.

Learning outcomes are important for recognition. It is important to emphasize on it since the important question asked to the student is-What you can do now that you are a graduate in Microbiology? The prior specification of the intended educational outcomes helps in maximizing educational effectiveness. All the educational activities from designing curriculum, to teaching pedagogies, to methods of evaluation are directed maximally towards the attainment of specific desired goals. The student's learning outcomes refer to the attainment of the particular competencies acquired by the student on completion of the undergraduate Microbiology program.

GRADUATE ATTRIBUTES IN MICROBIOLOGY

1. **Core subject/Disciplinary knowledge** – The students on graduating will have comprehensive knowledge about basic Microbiology techniques and acquire skill sets that make them relevant for the industry they wish to thrive.
2. **Developing research abilities and critical thinking** – The students are exposed to research by way of undertaking projects, which will inculcate analytical thinking, problem solving and raising thought provoking questions.
3. **Communication skill** – The students will have the ability to articulate their ideas, express themselves clearly orally and in writing. They will have a clear understanding of scientific communication and will be able to write reports of experiments, project proposals etc.
4. **Team player** – The students will be able to work amicably and fruitfully with their fellow mates. They can work effectively as a member of a team since they are coordinating and collaborating with peers in the laboratory and in the classrooms.
5. **Computer literacy** – The students will have the skill to use software like Excel for data representation and statistical analysis. They will also be able to use relevant software and bioinformatic tools for locating, retrieving and analyzing data from nucleic acid and protein databases.

6. **Soft skill development** – The new syllabi emphasize on quality teaching, holistic development and community engagement. The integration of co-curricular and extracurricular learning promotes crucial skills like time management, leadership skills, adaptability and interpersonal skills.
7. **Moral and ethical awareness** – The students have the ability to follow ethical practices, use a pragmatic approach, and have empathy towards their fellow mates. They will represent scientific information correctly, will not commit plagiarism and adopt an honest approach in all aspects of work.

PROGRAM OBJECTIVES

1. Upon graduation students will be able to acquire, retain and apply knowledge relevant to the diverse areas in Microbiology.
2. Students will be able to think rationally, communicate scientific concepts and demonstrate competency in Microbiology techniques.
3. Students will be able to develop skills of observation and draw logical conclusions from experiments.
4. The students will imbibe ethical and moral values to become good global citizens.
5. The students develop curiosity about various aspects in Microbiology and explore the subject to creatively solve problems.
6. To nurture capability and confidence in students so they can be future leaders.
7. engage in the varied disciplines of Microbiology through research and internship activities.
8. The students will apply verbal or non-verbal methods and tools of communication to present/convey scientific ideas and opinions

TEACHING LEARNING PROCESS

The teaching learning processes include blended learning and incorporate a variety of modes and a regular use of ICT as listed below:

1. **Classroom Teaching and Discussion** for topics which are intensely information-based. This is a very regular feature of all the courses in Microbiology. The students interact with the teachers and make the class lively.
2. **Flipped learning** for some topics are taken up to engage students and encourage active learning during class time by assigning students lecture materials and presentations to be viewed at home or outside of class.
3. **Laboratory Practical a**re an integral part of every course in Microbiology which helps in experiential learning.
4. **PowerPoint presentations** for topics which involve mechanisms, structures, processes and images based concepts are used routinely as visualization helps in assimilation of concepts better.
5. **Use of Animations, Video** for biological mechanisms. These have proved to be very helpful to understand the concepts of molecular biology, immunology, industrial processes and instrumentations.
6. **Model Making** for the structures of biomolecules, viruses, eukaryotic cells, industrial fermentation to make the learning process interesting.
7. **Problem Solving** is encouraged during the practicals and conceptual problems in Molecular biology and Biochemistry.
8. **Group Research Projects** are given to foster critical thinking and analytical skills through hands-on learning. Students are required to design experiments to solve/answer a problem and formulate hypotheses. This also helps improve soft skills.
9. **Presentations by the Students** on topics from syllabus and research projects they conduct. They learn presentation of data, interpretation of data and articulation during presentation.
10. **Guest lectures** are conducted by experts from different areas of Microbiology to create awareness among students about recent advances, and opportunities in the field.
11. **Workshops** are arranged to give the students hands-on learning experience and develop problem solving skills.
12. **Visit to Industries/Laboratories and field trips** related to Microbiology like fermentation, food, diagnostics etc. are organized to obtain on-site information by observing places, instruments and processes to acquaint the students with the real-life working environment of the professional microbiologists.

13. Community based learning broadens their perspective of the subject of Microbiology and relates science to day to day life.

ASSESSMENT METHODS

Multiple Choice Questions (MCQ) are one of the predominant forms of assessment used for continuous assessment -I on a regular basis based on the topics covered during the class

1. **Short-Answer Questions** are used to assess the understanding, remembering and analytical skills of students during end semester examinations.
2. **Pictorial Quizzes and Crosswords** are used to sharpen the comprehension of the students, relate and apply the subject knowledge. These are given as part of continuous assessment II
3. **Group Presentations** are used to assess the articulation skills of the student. These activities also help develop soft skills. These are carried out both during the duration of the teaching learning processes and as part of Continuous assessment II.
4. **Assignment Writing** is used to assess the writing abilities of the students as part of continuous assessment II and practical examination.
5. **Problems based on Molecular biology and Biochemistry** are given as part of continuous assessment II to evaluate the conceptual knowledge of the students.
6. **Abstract/Proposal/Report Writing** is used to assess logical and scientific communication of the student. These are given as part of Continuous assessment or practical exam assessment and also help students to organize, analyze and interpret data.
7. **Data Interpretation** is also another assessment method which is used to develop analytical skills of the students. This assessment is used during practical sessions work as well as during conduction of project work.
8. **Case studies, and Problem-Solving questions** are generally given during the practical sessions. This helps to build their ability to solve real life problems.
9. **Scientific movie screening** is used as a part of CA II to assess the ability of the students to comprehend scientific ideas and concepts.
10. **Viva-voce** during the practical examination is used to assess the overall knowledge and intelligence of the students.

EVALUATION SCHEME

a. Major and Minor Paper:

Theory: Total 75 marks

SEE = 50 marks

CA = 25 marks

CA distribution- CA-1 + CA- 2, the evaluation pattern will be based on tests, assignments and submissions.

Practical:Total 25 marks

b. VSC and SEC:

Practical: Total 25 marks

CA = 25 marks, the evaluation pattern will be experiment/ task based/ case study or any other similar.

c. OE

SEE: Total 25 marks

CA = 25 marks

CA distribution- CA-1 + CA- 2, the evaluation pattern will be based on tests, assignments and submissions.

30% questions would be based on evaluative and analytical thinking and 10% based on applying the knowledge and 60% based on understanding and remembering.

Discipline Specific Core Courses–Major/Minor Core Courses

Course Code JUSMIC-DSC101/ JUSMIC-MIN101	Course Title: Foundation in Microbiology	Credits: 03 Lectures/Week:
Course description	This course involves the study of microorganisms with particular emphasis on the biology of prokaryotes. The main focus of the course is to lay a strong foundation by exposing the students to the diversity in microbes, techniques to view them, cultivate and control them.	
Learning objectives	• Laying a strong foundation in the subject of Microbiology. • Introduce microbial diversity and their applications. • Give a detailed structure of prokaryotes and their comparison with eukaryotes and Archaea. • Understand the techniques for viewing microorganisms along with the control, cultivation and preservation of microorganisms.	
Course Outcomes	• Explain the principles of methods underlying staining and visualization of structure. • Outline general properties, structure, biological and economic importance of various groups of microorganisms and describe various culturing and preservation methods of microorganisms. • Enlist the different methods of sterilization and their applications. • Evaluate the effectiveness of an antimicrobial agent and classify microorganisms on the basis of nutritional requirements.	
	THEORY	45 lectures
1.	HISTORY AND SCOPE OF MICROBIOLOGY	02 lectures
	• Introduction to the microbial world. • Golden age of Microbiology • Modern developments in Microbiology • Scope and Relevance of Microbiology (Microbes and Human Welfare, Modern Biotechnology and RDT, Microbes and Human Diseases examples	

2.	**CLASSIFICATION AND DIVERSITY OF MICROBIAL WORLD**	**06 lectures**
	The Place of Microorganisms in the Living world: • Haeckel's Kingdom Protista • Prokaryotic and Eukaryotic Protists • Whitaker's Kingdom concept • Carl Woese's three kingdom Classification	
	Types of Microorganisms and their biological significance • Bacteria- Actinomycetes, Rickettsia, Coxiella, Chlamydia, Mycoplasma • Archaebacteria • Fungi – Yeasts and Molds, Slime molds • Cyanobacteria and Algae • Protozoa • Viruses	
3.	**OBSERVING MICROORGANISMS THROUGH A MICROSCOPE**	**08 Lectures**
	The Light Microscopy: Construction, Principle & Application with ray diagram • Bright Field Microscope • The Dark Field Microscope • The Phase Contrast Microscope • Fluorescence Microscope Electron Microscopy: Construction, Principle & Application with ray diagram • Transmission Electron Microscope • Scanning Electron Microscope • Specimen preparation in TEM: Staining, Shadowing with metals, Freeze Etching	
4.	**PROKARYOTIC STRUCTURE AND FUNCTION**	**08 Lectures**
	• Morphology of Bacteria • Prokaryotic Cell Membranes- Bacteria and Archaebacteria • The Cytoplasmic matrix: cytoskeleton, inclusion bodies, ribosomes • The Nucleoid, Plasmids • The Bacterial, Mycobacterial and Archaebacterial Cell wall • Overview of Protein Secretion in prokaryotes • Components external to the cell wall: Capsules, Slime layers, S-layers, Pili and Fimbriae, Flagella • The Bacterial Endospore • Comparison of Bacterial, Archaebacteria and Eukaryotic cell.	

5.	**CONTROL OF MICROORGANISMS AND BIOSAFETY**	11 Lectures
	• Terminology and Methods of Microbial Control • Microbial Death and factors affecting microbial death • How Antimicrobial agents work: Mode of action	
	Physical methods of Microbial Control • Heat: Moist & Dry • Low temperature • Filtration • Radiations	
	Chemical methods of Microbial Control • Choosing a Microbicidal Chemical • Factors that affect the germicidal activity of chemicals • Chemical agents – Tabulate with mode of action and applications	
	Biosafety levels and Cabinets	
6.	**NUTRITION AND CULTIVATION OF MICROORGANISMS**	**10 lectures**
	• Nutritional requirements: Carbon, Oxygen, Hydrogen, Nitrogen, Phosphorus, Sulphur and growth factors. • Physicochemical parameters for growth (pH, temperature, Oxygen requirement and Osmotic pressure) • Nutritional types of microorganisms • Classification of Culture media with examples • Preservation of microorganisms • Culture Collection Centers	
References:	1. Willey, J. M., Sherwood, L. & Woolverton, C. J. (2011). Prescott, Harley and Klein's Microbiology 7th ed. New York: McGraw-Hill. 2. Pelczar, M., Reid, R. and Chan, E. (1986). Microbiology 5th ed. New York: McGraw-Hill 3. Talaro, K. P., &Talaro, A. (2009). Foundations in microbiology: Basic principles 7th ed. Boston: WCB/McGraw- Hill.	

EVALUATION SCHEME

The students will be evaluated based on continuous assessments(CA) and semester end exams (SEE).

Theory: Total 75 marks

SEE = 50 marks

CA = 25 marks

CA distribution- CA-1 + CA- 2, the evaluation pattern will be based on tests, assignments and submissions.

Bloom's Taxonomy for SEE

TOPIC	KNOWLEDGE	UNDERSTANDING	APPLICATION/ ANALYTICAL	TOTAL MARKS
1	1	1	1	3
2	2	2	2	6
3	4	3	2	9
4	4	3	2	9
5	4	3	4	11
6	5	4	3	12
TOTAL MARKS PER OBJECTIVE	20	16	14	50
%WEIGHTAGE	40	32	28	100

Course Code JUSMIC-DSCPR101/ JUSMIC-MINPR101	MICROBIOLOGY PRACTICAL-I	Credits: 01 Lectures/Week: (2hrs)
Course Description	**To introduce students to Microbiology laboratory, understand various instruments and ways to visualize microorganisms in laboratory. The course gives hands-on training to cultivate microbes and study the effects of various parameters on growth of microorganisms.**	
Learning Objectives	• **Perform Gram's staining and special staining to demonstrate the different structures of bacteria.** • **Demonstrate the effect of UV light on different types of bacteria.** • **Aseptically transfer culture media and prepare slants and plates.** • **Isolate microorganisms on Nutrient agar and MacConkey's agar and study its colony characteristics.**	
Course Outcome	• **Differentiate organisms based on their morphology and Gram's nature.** • **Cultivate microorganisms using appropriate isolation techniques.** • **Evaluate the effect of disinfectant by disc diffusion technique.**	
	PRACTICAL	
	1. Introduction to laboratory equipments, disinfection and discarding techniques in the laboratory 2. Microscopy: Parts of a microscope 3. Measurement of cell dimensions: Micrometry 4. Specimen Preparation for light microscopy- smear preparation, fixation, simple (monochrome) and differential staining (Gram's staining) 5. Special staining- Cell wall staining, negative staining for capsules, spore staining. 6. Media preparation 7. Aseptic transfer techniques 8. Isolation technique 9. Permanent slides for microbial diversity 10. Effect of UV radiations on microbial growth 11. Evaluation of disinfectants using disc diffusion technique 12. Demonstration- Phenol coefficient test	

Course Code JUSMIC-DSC201/ JUSMIC-MIN201	Course Title: Microbial Metabolism and Genetics	Credits: 03 Lectures/Week:
Course description	This course provides an introductory overview of DNA replication and microbial metabolism. It will help in developing fundamental understanding and application of molecular techniques based on DNA. The other aspect of this course is to build a strong foundation in Enzymology.	
Learning objectives	• Understand the fundamentals of biochemistry, illustrate the cellular pathways and understand its role in the growth and metabolism of prokaryotes. • Familiarize with the concepts of enzymes, cofactors, coenzymes, active site, catalytic site, substrate binding site and allosteric enzymes. • Conceptualize basics of prokaryotic genetics. • Summarize the events of DNA replication and the role of the proteins and enzymes in prokaryotes.	
Course Outcomes	• Define metabolism,differentiate between catabolism and anabolism and discuss analysis of the metabolic pathways using different experimental approaches. • Tabulate the different classes of enzymes and state their properties and discriminate between the enzyme inhibitors based on their interaction with the enzyme and its effect on enzyme kinetics. • Compare and contrast the mode of DNA replication in prokaryotes and eukaryotes. • Explain the rolling circle mode of replication in plasmids and bacteriophages.	
	THEORY	45 lectures
1.	BIOLOGICAL FUNCTIONS OF BIOMOLECULES	07 lectures
	• Chemical Bonding types and bonding patterns in Biomolecules • Water as a Biological solvent • Non informational Macromolecules- polysaccharides and lipids • Informational Macromolecules- Nucleic acids, amino acids and proteins.	

2.	**ENZYMES AS BIOCATALYST**	**08 lectures**
	• Structure of enzyme, Apoenzyme, cofactors, prosthetic group, coenzyme, allosteric enzymes and its significance • Mechanism of action of enzymes: active site, transition state complex and activation energy. • Classification of enzymes • Lock and key hypothesis, and Induced Fit hypothesis • Effect of pH, temperature and inhibitors on enzyme activity • Michaelismenton's equation and Line weaver's plot • Mechanism of multisubstrate enzyme- Ordered, Random and Pingpong	
3.	**MICROBIAL METABOLISM**	**10 Lectures**
	• Introduction to metabolism and metabolic pathways • Introduction to thermodynamics and thermodynamics of phosphate compounds • ATP- structure, properties and its role Mechanism of generation of ATP- fermentation, respiration and photosynthesis	
4.	**MICROBIAL GROWTH**	**05 Lectures**
	• Definition of growth, Growth curve, Mathematics of growth • Synchronous growth, Continuous growth (Chemostat and Turbidostat) • Microbial growth in natural environment, Biofilms, Quorum sensing techniques	
5.	**DNA, GENES AND GENOMES**	**06 Lectures**
.	Nucleic acid structure: • Watson and Crick model of DNA, A and Z forms of DNA (Self study) • Types, structures and functions of RNA: mRNA, tRNA, rRNA, snRNA, miRNA, hn RNA Nucleic acid chemistry: • Denaturation of double helical DNA and RNA • Hybrid formation of nucleic acid from different species • Non enzymatic transformations of nucleotides and nucleic acids • Methylation of nucleotide bases in DNA Organization of Chromosome structure in eukaryotes	

6.	**DNA REPLICATION**	**09 Lectures**
	• Historical perspective- Conservative, dispersive, semi-conservative • Prokaryotic DNA replication- Details of molecular mechanisms involved in Initiation, Elongation and Termination • Enzymes and proteins associated with DNA replication-Primase, Helicase, Topoisomerase, SSB, DNA polymerases, Ligases, Ter and Tus proteins • Rolling circle mode of DNA replication	
References:	1. Willey, J. M., Sherwood, L. & Woolverton, C. J. (2011). Prescott, Harley and Klein's Microbiology 7th ed. New York: McGraw-Hill. 2. Lehninger A. L., Nelson D. L. & Cox M. M. Lehninger principles of biochemistry, New York: Worth Publishers, 5th Ed., 2008. 3. Madigan M. T., Martinko J. M. Brock biology of microorganism, Upper Saddle River, NJ: Prentice Hall/Pearson Education, 8th Ed., 1997. 4. Russell P. J., iGenetics – A Molecular approach, Pearson Education, Inc., 2nd Ed., 2006 5. Conn and Stumpf., Outlines of Biochemistry., 5th Ed. Wiley student edition	

EVALUATION SCHEME

The students will be evaluated based on continuous assessments(CA) and semester end exams (SEE).

Theory: Total 75 marks

SEE = 50 marks

CA = 25 marks

CA distribution- CA-1 + CA- 2, the evaluation pattern will be based on tests, assignments and submissions.

Bloom's Taxonomy for SEE

TOPIC	KNOWLEDGE	UNDERSTANDING	APPLICATION/ANALYTICAL	TOTAL MARKS
1	3	2	3	8
2	4	3	2	9
3	4	3	3	10
4	2	2	2	6
5	3	2	2	7
6	4	4	2	10
TOTAL MARKS PER OBJECTIVE	20	16	14	50
% WEIGHTAGE	40	32	28	100

Course Code: JUSMIC-DSCPR201/ JUSMIC-MINPR201	MICROBIOLOGY PRACTICAL- II	Lectures/Week: (2hrs) Total 30hr
Course Description	This course will familiarize students with practical aspects of biochemistry that includes detection of biological macromolecules, use of colorimeter and molecular aspects of DNA through its extraction.	
Learning Objectives	• Qualitatively detect biomolecules and use a colorimeter. • Study enzyme kinetics and the effect of various parameters on enzyme activity. • Understand the various phases of the microbial growth curve. • Perform molecular techniques like extraction of DNA.	
Course Outcome	• Analyze various samples for presence of different biomolecules. • Give significance of various growth phases of a microorganism. • Verify the Beer-lambert's law. • Enumerate microorganisms using a viable count method.	
	PRACTICALS	
	1: Qualitative detection of biomolecules- carbohydrates, proteins, amino acids and nucleic acids 2. Determination of lambda max 3. Verification of Beer-Lambert's Law 4. Effect of temp, pH and substrate concentration on enzyme activity 5. Viable Count- Pour plate and Spread plate 6. Study of Growth Curve of *E.coli* 7. Extraction of DNA from onion	

Open Elective Course

Course Code JUSMIC-OE101/ JUSMIC-OE201	Course Title: Health and Hygiene	Credits: 02 Lectures/Week:02
Course description	This course involves studying the importance of health and how hygiene practices can help to safeguard us from infectious diseases. The other focus is to familiarise students with diseases of public health importance and epidemiological principles.	
Learning Outcome	• Understand disease transmission and infection mechanisms. • Illustrate the significance of normal flora of humans and give examples of microorganisms residing in different anatomical sites. • Role of hygiene and its implications in human health. Explain the types of infections, process of infection and the carrier states. • Discuss the basic principles of Epidemiology and its significance.	
Course Outcome	• State the importance of hygiene practices in our lives. • Correlate various aspects of human health and hygiene with diseases. • Enlist different methods by which infectious agents can spread in a community	
Topic	THEORY	30 Lectures
1.	THE HUMAN HOST	05 Lectures
	• Contact, Infection and Disease • Resident flora: the human as a habitat • Indigenous flora of specific regions	
2.	THE PROGRESS OF AN INFECTION	07 Lectures
	• The portal of entry • Mechanism of invasion and establish of the pathogen • Patterns of infection • Signs and symptoms: Warning signals of disease • The portal of Exit	
3.	EPIDEMIOLOGY	08 Lectures
	• Principles of epidemiology • Hospital- acquired: Nosocomial Infections • Emerging and Reemerging infections • Biological warfare and Biological weapons	

4.	**HYGIENE & ITS IMPORTANCE**	**02 Lectures**
	• Hygiene hypothesis • Personal and domestic hygiene • Role of hygiene in disease implications	
5.	**HYGIENE PRACTICES**	**02 Lectures**
	• Personal hygiene • Water, Sanitation and Environmentally related hygiene (WASH)	
TOPICS	**TUTORIALS**	**06 Lectures**
	• Current epidemics/pandemics • Microbial Diseases • Antimicrobial resistance • Role of normal flora	
	EVALUATION SCHEME	
	The students will be evaluated based on semester end exams (SEE) and Continuous assessment (CA) **SEE: Total 25 marks** **CA: Total 25 marks** CA distribution- CA-1 + CA- 2, the evaluation pattern will be based on tests, assignments and submissions.	

Bloom's Taxonomy for SEE

TOPIC	KNOWLEDGE	UNDERSTANDING	APPLICATION/ ANALYTICAL	TOTAL MARKS
1	2	2	1	5
2	3	2	3	8
3	3	3	2	8
4	1	1		2
5	1		1	2
TOTAL MARKS PER OBJECTIVE	10	8	7	25
% WEIGHTAGE	40	32	28	100

REFERENCES	1. Talaro, K. P., &Talaro, A. (2009). *Foundations in microbiology: Basic principles 7th ed.* Boston: WCB/McGraw-Hill. 2. Madigan, M. T., Martinko, J. M. (2009). *Brock biology of microorganisms 12th ed.* Upper Saddle River, NJ: Prentice Hall/Pearson Education 3. Ananthanarayan&Panicker's, Textbook of Microbiology, Universities Press(India) Pvt Ltd. , 10th Ed., 2017	

Open Elective Course

Course Code JUSMIC-OE202	Course Title: Diet Management	Credits: 02 Lectures/Week: 02 (Total 30 hrs)
Course Description	The course is designed to empower students with the knowledge and skills required to make informed decisions about dietary choices. It covers key topics such as Macronutrients, types of diets and meal planning to help them achieve their fitness goal.	
Learning outcome	• Comprehensive understanding of diet and its importance in overall health and well-being • Create personalized and balanced meal plans tailored to meet individual health goals and preferences • Critically evaluate diet trends and fads • Establish sustainable habits that contribute to long-term health and wellness.	
Course Outcome	• Define body composition and explain the role of food constituents. • Understand the balanced diet and discuss different types of diet • Design personalized nutrition plans to cater to individual health and lifestyle factors.	
Title	THEORY	Lectures
1.	FOOD SCIENCE AND NUTRITION	08 Lectures
	• Body Composition • Sources and Impact on human health • Macronutrients- Carbohydrates, Proteins and Fats • Micronutrients- Vitamins and Minerals • Hydration- water and fluids • Phytochemicals and Nutraceuticals- antioxidants, probiotics.	

2.	**ENERGY VALUE OF FOOD**	**05 Lectures**
	• Methods of measurement of energy, value of nutrients – direct and indirect, basal metabolic rate–measurement and factors affecting BMR	
3.	**BALANCED DIET**	**03 Lectures**
	• Food composition and nutrient content for: • Sedentary lifestyle • Moderate active lifestyle • Pregnant women	
4.	**TYPES OF DIET**	**03 Lectures**
	• FAD diet • Keto Diet • Veganism • Carnivore Diet	
5.	**MEAL PLANNING**	**05 Lectures**
	• RDA • Preparing a food list using ICMR tables and Food exchange list • Making a menu	

6.	**TUTORIALS**	**06 Lectures**
	• Meal Planning for different groups • Calculation of energy value	
	EVALUATION SCHEME	
	The students will be evaluated based on semester end exams (SEE) and Continuous assessment (CA) **SEE: Total 25 marks** **CA: Total 25 marks** CA distribution- CA-1 + CA- 2, the evaluation pattern will be based on tests, assignments and submissions.	

Bloom's Taxonomy for SEE

TOPIC	KNOWLEDGE	UNDERSTANDING	APPLICATION/ ANALYTICAL	TOTAL MARKS
1	4	2	2	8
2	2	2	1	5
3	1	1	2	4
4	1	1	1	3
5	2	2	1	5
TOTAL MARKS PER OBJECTIVE	10	8	7	25
% WEIGHTAGE	40	32	28	100

REFERENCES

1. ICMR Report, 2020, Nutrient Requirements for Indians
2. Food Science (4th edition) –B. Srilakshmi
3. Foods-facts and principles (3rd edition) –Manay N.S. and Shadasaraswamy

Skill Enhancement Elective Courses

Course Code JUSMIC-SEC101/ JUSMIC-SEC201	Course Title: Fermentation technology (Sem I &Sem II)	Credits: 02 Practical/Week:4 hours (Total 60hrs)
Course Description	**The focus of this course is to study the role of microorganisms in production of commercial products. This course will provide insights about various aspects of fermentation technology and the process plan.**	
Learning objectives	• **Inculcate bio entrepreneurial skills to convert the microbes and their products into an enterprise.** • **Understand practical aspects of screening industrially important microorganisms from the environment.** • **Study the design and construction of fomenters and parameters to be monitored and controlled in the fermentation process.** • **Understand different types of fermentation processes with examples**	
Course Outcome	• **Use screening techniques to isolate an antibiotic producer.** • **Design fermentation medium for a process** • **Demonstrate the effect of various environmental parameters on the growth of microorganisms.** • **Carry out wine production on a lab scale.**	
Practical		
	1. Introduction to fermentation • Fermentation Technology- Definition and Scope • Range of fermentation processes and products (enlist with definitions and examples) • The fermentation process outlines • Fermentation Economics 2. Fermentation Basics- Screening, strain improvement • Perform screening of antibiotic producers from soil- Crowded plate technique and Wilkins overlay • Effect of pH, temperature and osmotic pressure on the growth of microorganisms • Preservation of microorganisms	

	3. Fermentation essentials • Components and types of media • Inoculum development • Sterilisation 4. Fermentation types with examples • Batch, Fed-batch, Continuous • Aerobic and Anaerobic • Solid Substrate fermentation • Surface and Submerged fermentation • Dual fermentation 5. Set up Wine fermentation in Laboratory

EVALUATION SCHEME

The students will be evaluated based on semester end exams (SEE) and Practical exams

Practicals= 25 marks, 1.5 hours

CA= 25 Marks, the evaluation pattern will be experiment/ task based/ case study or any other similar

References	1. An introduction to industrial microbiology- Sivakumaar 2. Stanbury P. F., Whitaker A. & Hall S. J., Principles of Fermentation Technology, Aditya Books Pvt. Ltd, New Delhi. 2nd Ed., 1997. 3. CasidaL.E. (2009).IndustrialMicrobiologyReprint, New Age International (P) Ltd, Publishers, New Delhi. 4. R. Puvana Krishnan, S. Sivasubramanian. (2012). Microbial technology: conceptsand application1st Ed. Chennai MJP Publishers

Vocational Skill Elective Courses

Course Code JUSMIC-VSC101/ JUSMIC-VSC201	Course Title: Introduction to Clinical Microbiology	Credits: 02 Practical/Week:4 hours (Total 60hrs)
Course description	This course will enable the students to understand the principles and practically perform methods used in clinical microbiology laboratories for diagnosis of infections.	
Learning objectives	• Understand the laboratory safety, routine and specialized microbiological skills and techniques. • Conceptualize different types of laboratories and their organization. • Introduce basic techniques of specimen collection, processing, handling, and clinical examination. • Understand the important virulence factors of a pathogen and its role in causing the disease.	
Course Outcomes	• Explain the organization and types of medical laboratories. • Isolate and identify normal flora from various sites. • Use appropriate selective and differential media to isolate pathogens. • Report the antibiogram of a pathogen isolated from a clinical sample using Kirby Bauer method of antibiotic sensitivity test.	
Practical		
1.	INTRODUCTION TO A MEDICAL LABORATORY • Types of Medical labs • Organization of hospital medical lab • Lab reagent preparation and calculation • Point of care testing & Total Lab Automation • Visit to a Clinical Laboratory	

2.	INTRODUCTION TO CLINICAL MICROBIOLOGY
	
	• Introduction to Syndromic Diagnostic Testing
	• Bacteriology- Staining & Culture techniques for bacteria.(Eg. Throat culture, Urine culture) and Antibiotic Susceptibility Tests
	  • Study of normal flora- sample collection technique
	  • Use of selective and differential media for clinical studies- SIBA CLED, SMA
	  • Demonstration of virulence factors in pathogens- coagulase and haemolysin
	  • AST by Kirby Bauer Method	

	• Parasitology- (Collecting & processing specimens for parasite examination, Detecting intestinal and blood parasites) • Virology- (Collecting & processing specimens for viruses- Cultivation, PCR and Serological testing) • Mycology- (Specimen collection, microscopy and culture)- Fungal wet mount
EVALUATION SCHEME	
The students will be evaluated based on semester end exams (SEE) and Practical exams **Practical**= 25 marks, 1.5 hours CA= **25 Marks,** the evaluation pattern will be experiment/ task based/ case study or any other similar	
References:	1. Basic medical lab techniques – Barbara Estridge 2. Forbes B.A., Sahm D.F. &Weissfeld A.S., Bailey and Scott's Diagnostic Microbiology, Mosby, Inc, 11th Ed., 2002.

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