St. Aloysius College (Autonomous) Jabalpur, M.P.
Department of Botany and Microbiology
B.Sc I year
Industrial Microbiology
Paper—1/ Major
Tools and techniques in Microbiology

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2. Tools and Techniques in Microbiology – Nath & Upadhyay
3. Principles & Techniques of Biochemistry & Molecular Biology Cambridge University Press- Wilson & Walker J 2020
4. Hand book of techniques in microbiology AS Karwa, MK Rai, HB Singh (A Laboratory guide to microbes)
5. Tools & Techniques of microbiology text book by Sundara S Rajan
6. Hand book of microbiology – PS Bisen and Kavita Verma
7. Practical Microbes A Laboratory Manual by B Senthil Kumar, Zothansganga, D Senbagam, N Senthil Kumar, G Gurusubramaniam (Paper Back – Kumar BS)

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Format for Syllabus of Theory Paper

Part A- Introduction			
Program: Certificate	**Class: B.Sc.**	**Year: 1St**	**Session: 2021-**
Subject: Industrial Microbiology			
1	**Course Code**	**S1INMB2T**	

2	**Course Title**	**Tools and Technique in Industrial Microbiology**	
3	**Course Type (Core Course/Elective/Generic Elective/Vocational/…..)**	**Core Course**	
4	**Pre-requisite (If any)**	**To study this course, a student must have had the subject Biology in Class/12th/certificate/diploma.**	
5	**Course Learning Outcomes (CLO)**	**To be able to understand the role and use of different tools and different modern techniques in the study's of Industrial Microbiology**	
6	**Credit Values**	**4**	
7	**Total Marks**	Max. Marks: 25+75	Min. Passing Marks: 33

Part B- Content of the Course

Total No. of Lectures- Tutorials- Practical (in hours per week): 60 Hrs
L-T-P:

Unit	Topics	No. of Lectures
1	**Microscopy and Microscopic Techniques** Principle and application of light microscopy, dark field microscopy, phase contrast microscopy, fluorescence microscopy, confocal microscopy, Electron Microscopy, scanning & transmission electron microscopy, AFM Atomic Force Microscopy, Micrometry, Camera Lucida software in Microscopy	**12 Hrs**
2	**Chromatography and Electrophoresis** ❖ Principle, application and affinity of paper chromatography (including 2-D & descending chromatography) ❖ Thin layer Chromatography – column packing & fraction collection ❖ Gel filtration chromatography and Ion Exchange Chromatography ❖ GLC and HPLC principle and application ❖ Principle and application of native polyacrylamide gel electrophoresis, SDS – polyacrylamide gel electrophoresis, 2D gel electrophoresis, isoelectric focusing, zymograph preparation, agarose gel electrophoresis	**12 Hrs**
3	**Spectrometry, Colorimetry, Turbidometry and Centrifugation** ❖ Principle and use of absorption spectra of biomolecules. Their analysis using UV and visible range. ❖ Principle and use of colorimetry ❖ Principle and use of turbidometry ❖ Principle and types of analytical centrifugation, RCF and sedimentation co-efficient, ultra centrifugation and types of gradient ❖ pH meter, autoclave, hot air oven,	**12 Hrs**

	incubator and BOD incubator and Laminar Air Flow.	
4	**Culture Techniques** ❖ Culture media, preparation, types- define differential, selective and enrichment culture media ❖ Isolation techniques – pour plate, spread plate, streak plate, serial dilution method. ❖ Pure culture, enrichment culture and micromanipulator. ❖ Maintenance and preservation of pure microbial cultures. ❖ Lyophilization and cryopreservation.	**12 Hrs**
5	**Sterilization and Staining Techniques** ❖ Sterilization – Principle & method of sterilization, physical and chemical agents of sterilization. ❖ Disinfectants, antiseptics, phenol coefficient ❖ Nature of dyes, physical and chemical theories of staining ❖ Principle, procedure and application of simple staining, negative staining, differential staining. ❖ Study of Aseptic techniques – preparation of cotton plugs for test tubes and pipettes, wrapping of petri plates and pipettes.	**12 Hrs**

Keywords/Tags; Techniques, microscopy, chromatography, spectrophotometry, sterilization

Part C- Learning Resources

Text Books, Reference Books, Other resources

Suggested Books:

1. Tools & Techniques in Microbiology – Nath & Upadhyay
2. Principles & Techniques of Biochemistry and Molecular Biology Cambridge University Press – Wilson & Walker J 2010
3. Hand book of techniques in microbiology AS Karwa, MK Rai, HB Singh (A Laboratory guide to microbes)
4. Tools & Techniques of microbiology text book by Sundara S Rajan
5. Hand book of microbiology – PS Bisen and Kavita Verma
6. Practical Microbes A Laboratory Manual by B Senthil Kumar, Zothansganga, D Senbagam, N Senthil Kumar, G Gurusubramaniam (Paper Back – Kumar BS)

2. Suggestive digital platform web links

Suggested equivalent online courses:

http://nptel.ac.in/courses/104/104/104104066/ analytical methods
http://nptel.ac.in/courses/102/107/102107028/ techniques tools

Part D – Assessment and Evaluation

Suggested Continuous Evaluation Methods:

Maximum Marks: 100

Continuous Comprehensive Evaluation (CCE): 25 marks University Exam (UE): 75 marks

Internal Assessment:	Class Test	15
Continuous Comprehensive	Assignment/Presentation	10

Evaluation (CCE): 25		
External Assessment: University Exam Section: 75 Time – 02:00 Hours	**Section (A):** Three Very Short Questions (50 words each) **Section (B):** Four Short Questions (200 words each) **Section (C):** Two Long Questions (500 words each)	03 × 03 = 09 04 × 09 = 36 02 × 15 = 30 **Total : 75**
Any remarks/ suggestions:		

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Part A- Introduction				
Program: Certificate	**Class: B.Sc.**	**Year: First**	**Session: 2021**	
Subject: Industrial Microbiology				
1	**Course Code**	**S1INMB1P**		
2	**Course Title**	**Techniques in Industrial Microbiology**		
3	**Course Type (Core Course/Elective/Generic Elective/Vocational/….)**	**CORE**		
4	**Pre-requisite (If any)**	**To study this course, a student must have had the subject BIOLOGY in class/12th/certificate/diploma.**		
5	**Course Learning Outcomes (CLO)**	**On completion of this course, learners will able to: To be able to understand the role and use of different tools and different modern techniques in the study's of industrial microbiology**		
6	**Credit Value**	**2**		
7	**Total Marks**	Max. Marks: 25+75	Min. Passing Marks: 33	

Part B- Content of the Course		
Total No. of Lectures- Tutorials- Practical (in hours per week): 30 hrs **L-T-P:**		
Unit	**Topics**	**No. of Lectures**
1	Study of fluorescent micrographs to visualize bacterial cells	**30 hrs**
2	Ray diagram of phase contrast microscopy & electron microscopy	
3	Separation of mixture in by paper/ thin layer chromatography	
4	Demonstration of column packing in any form of column chromatography	
5	Separation of protein mixture by any form of chromatography	
6	Separation of protein mixture by polyacrylamide Gel Electrophoresis page	
7	Determination of Lamda max for and unknown sample and calculation of extinction coefficient	
8	Separation of component of a given mixture using a laboratory scale centrifuge	
9	Understand density gradient centrifugation with help of pictures	
10	To study the principle and application of important instruments- colony counter, autoclave, incubator, hot air oven, pH meter, laminar air flow	
11	Preparation of culture media for bacterial cultivation	
12	Sterilization of medium by using autoclave and assessment for sterility	

13	Sterilization of glassware using hot air oven and assessment for sterility	
14	Sterilization of heat sensitive material by membrane filtration and assessment for sterility	
15	Demonstration of the presence of micro flora in the environment by exposing nutrient agar plates to air	
16	Simple staining, Gram staining, methylene blue staining	
17	Pure culture techniques, pour, streak & spread. Use of inoculation loop and needle, demonstration	
18	To study the principle and application of incubators, centrifuge. Different types of filter and colony counter, calorimeter and spectrophotometer	
19 Innovation	Study of effectiveness of different sanitizers	

Keywords/Tags: MICROBIAL PRACTICAL TECHNIQUES

Part C- Learning Resources

Text Books, Reference Books, Other Resources

Suggested Readings:

Essential of Practical Microbiology 2Nd Edition 2021 by SASTRY APURBA S, Jaypee

Suggestive digital platforms web links

http://nptel.ac.in/courses/104/104/104104066/ analytical methods

http://nptel.ac.in/courses/102/107/102107028/ techniques tools

Suggested equivalent online courses:

Part D- Assessment and Evaluation

Suggested Continuous Evaluation Methods:

Internal Assessment	Marks	External Assessment	Marks
Class Interaction/ Quiz	**10**	**Viva Voice on Practical**	**15**
Attendance	**5**	**Practical Record File**	**10**
Assignments (Charts/Model Seminar/ Rural Service/ Technology Dissemination/ Report of Excursion/ Lab Visits/ Survey/ Industrial Visit)	**10**	**Table work/ Experiments** Major Exercise 20 marks, Two minor exercise 10 marks each, spotting 10 marks	**50**
TOTAL	**25**		**75**

Any remarks/ suggestions:

St. Aloysius College (Autonomous) Jabalpur, M.P.
Department of Botany and Microbiology
B.Sc I year
Industrial Microbiology
Paper—2/ Minor
Fundamentals of Industrial Microbiology

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Suggested Readings:

1. Microbiology- Pelczar, Chan and Kreig, Ingrahm.
2. General microbiology- Stainier, Ingharam, Wheelis and Painter.
3. Biology of Microorganisms- Brook and Madigan.
4. Fundamental Principles of Bacteriology- A.J. Salle.
5. Introduction to Microbiology- Ingraham and Ingraham.
6. Tools and Techniques in Microbiology by Nath and Upadhyay.
7. Powar C.B. and H.F. Daginawa (2003). General Microbiology Vol.2; Himalaya Publishing House.
8. Dubey R.C. and D.K. Maheswari (2004). A text book of Microbiology, 1st Edition; S.C. Chand and Company Ltd.

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Format for Syllabus of Theory Paper

Part A – Introduction			
Program: Certificate	**Class: B.Sc.**	**Year: First**	**Session: 2021-2022**
Subject: Industrial Microbiology			
1	**Course Code**	**S1INMB2T**	
2	**Course Title**	**FUNDAMENTALS OF INDUSTRIAL MICROBIOLOGY**	
3	**Course Type (Core Course/ Elective/ Generic Elective/ Vocational/…..)**	**CORE COURSE**	
4	**Pre-requisite (if any)**	**To study this course, a student must have had the subject Biology in class/12th**	
5	**Course Learning Outcome (CLO)**	To understand the role and significance of microorganisms. Be able to identify and classify the important microorganisms. To understand contributions of important scientists in the field.	
6	**Credit Value**	**4**	
7	**Total Marks**	Max. Marks: 25+75	Min. Passing Marks: 33

Part B – Content of the Course		
Total No. of Lectures- Tutorials- Practical (in hours per week): 60 hrs **L-T-P:**		
Unit	**Topic**	**No. of Lectures**
1	HISTORY AND SCOPE 1.1 Development of Industrial Microbiology 1.2 Germ Theory of Disease 1.3 Scope and Application of Industrial Microbiology in human welfare. 1.4 Contribution of – A.V. Leeuwenhoek, Alexander Fleming, Louis Pasteur, Robert Koch, Edward Jenner, Joseph Lister. 1.5 Development of various Microbiological techniques and Golden Era of Industrial Microbiology. 1.6 Fundamentals of rDNA technology	**10 hrs**
2	MICROBIAL DIVERSITY: A 2.1 Systems of Classification – Binomial Nomenclature, Whittaker's five kingdom, Carl Woese's three domain classification system and their utility. 2.2 VIRUS: Classification, General characteristics, Structure and Reproduction of viruses. 2.3 Viroids and Prions 2.4 Life cycle of RNA and DNA virus, Lytic cycle and Lysogeny 2.5 BACTERIA: General characteristics 2.6 Classification, Ultra structure and Reproduction of bacteria 2.7 Role of bacteria in Industries.	**14 hrs**

3	MICROBIAL DIVERSITY: B 3.1 Bacteria with unusual properties: General characteristics, occurrence, reproduction and economic importance of the following:- *Cyanobacteria*, *Mycoplasma*, *Rickettsia* and *Actinomycetes*. 3.2 Beneficial and harmful microbes and their role in daily life 3.3 Archaea- habit and general morphological characters 3.4 Important Representative of Archaea- Methanogens and thermophiles.	**14 hrs**
4	MICROBIAL DIVERSITY: C (EUKARYOTIC MICROORGANISMS) 4.1 Morphological features, classification and characteristics of Myxomycetes (Slime Mould) 4.2 Some microbiologically important Micro Fungi – *Rhizopus*, *Mucor*, *Neurospora*, *Aspergillus*, *Penicillium*, *Yeast* and *Agaricus*. 4.3 General account of Microbiologically important Algae. 4.4 Role of Fungi in Medicines and in Industries.	**12 hrs**
5	APPLICATIONS OF MICROBES IN INDUSTRIAL MICROBIOLOGY: 5.1 Application in human therapeutics. 5.2 Agriculture (Biofertilizers and Mycorrhizae) 5.3 Environmental and Food Technology. 5.4 Use of Prokaryotic and Eukaryotic microorganisms in Biotechnological applications. 5.5 Genetically engineered microbes for Industrial application. 5.6 Alternative source of Energy.	**10 hrs**

Keywords/ Tags: History and diversity of micro-organisms

Part C – Learning Resources

Text Books, Reference Books and Other books

Suggested Readings:

1. Microbiology- Pelczar, Chan and Kreig, Ingrahm.
2. General microbiology- Stainier, Ingharam, Wheelis and Painter.
3. Biology of Microorganisms- Brook and Madigan.
4. Fundamental Principles of Bacteriology- A.J. Salle.
5. Introduction to Microbiology- Ingraham and Ingraham.
6. Tools and Techniques in Microbiology by Nath and Upadhyay.
7. Powar C.B. and H.F. Daginawa (2003). General Microbiology Vol.2; Himalaya Publishing House.
8. Dubey R.C. and D.K. Maheswari (2004). A text book of Microbiology, 1st Edition; S.C. Chand and Company Ltd.

Suggested equivalent online courses:

BASIC MICROBIOLOGY http://nptel.ac.in/courses/102/103/102103015

Part D – Assessment and Evaluation

Suggested Continuous Evaluation Methods:
Maximum Marks: 100
Continuous Comprehensive Evaluation (CCE): 25 Marks University Exam (UE): 75 Marks

Internal Assessment: Continuous Comprehensive Evaluation (CCE): 25	Class Test Assignment/ Presentation	15 10
External Assessment: University Exam Section: 75 Time – 02:00 hours	**Section (A):** Three Very Short Questions (50 words each) **Section (B):** Four Short Questions (200 words each) **Section (C):** Two Long Questions (500 words each)	03 × 03 = 09 04 × 09 = 36 02 × 15 = 30 **Total: 75**

Any remarks/ suggestions:

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1. Practical Microbiology by Dr. R.C. Dubey & D.K. Maheshwary. S Chand Publications.
2. Microbiology: A Laboratory Manual by James G. Cappuccino & Natalie Sherman.
3. Experiments in Microbiology Plant Pathology, Tissue Culture Microbial Biotechnology by A.R. Aneja. New Age International Publishers

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http://nptel.ac.in/courses/102/103/102103044/ techniques and tools and microbiology
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Syllabus of Practical Paper

Part A – Introduction			
Program: Certificate	**Class: B.Sc.**	**Year: First**	**Session: 2021-22**
Subject: Industrial Microbiology			
1	**Course Code**	**S1INMB2P**	
2	**Course Title**	**BASIC EXERCISES IN INDUSTRIAL MICROBIOLOGY**	
3	**Course Type: (Core Course/Elective/Generic Elective/ Vocational/…..)**	**CORE COURSE**	
4	**Pre-requisite (if any)**	**To study this course, a student must have had the subject BIOLOGY in class/12th**	
5	**Course Learning Outcomes (CLO)**	**On completion of this course, learners will be able to :** **To stain and identify bacteria and understand the working of various instruments used in**	

		basic study of bacteria.	
6	**Credit Values**	**2**	
7	**Total Marks**	Max. Marks: 25+75	Min. Passing Marks: 33

Part B – Content of the Course

Total No. of Lectures- Tutorials- Practical (in hours per week): Total – 30 hrs
L-T-P:

Unit	Topic	No. of Lectures
1	Safety measures in Laboratory	**30 hrs**
2	Cleaning and Sterilization of glassware's.	
3	Use of microscope.	
4	Study of aseptic techniques – Preparation cotton plug for test tubes, wrapping of petri plates	
5	Staining of bacteria, Metachromatic staining, cell wall staining, spore staining, Staining of Fungi and Algae	
6	Microscopic Examination of living microorganisms.	
7	Use of micrometre and Camera Lucida.	
8	Preparation of Bacterial smear.	
9	Study of Rhizopus, Mucor, Penicillium, Aspergillus and yeasts.	
10	Slide culture techniques for studying morphology of Moulds.	
11	Microscopic observation of VAM Infection and Cyanobacteria.	
12	Study of mushroom and types.	

Keywords/ Tags: Basic Microbiology Practicals

Part C – Learning Resources

Text Books, Reference Books, Other Resources

Suggested Readings:

1. Practical Microbiology by Dr. R.C. Dubey & D.K. Maheshwary. S Chand Publications.
2. Microbiology: A Laboratory Manual by James G. Cappuccino & Natalie Sherman.
3. Experiments in Microbiology Plant Pathology, Tissue Culture Microbial Biotechnology by A.R. Aneja. New Age International Publishers

Suggested equivalent online courses:
http://nptel.ac.in/courses/102/103/102103044/ techniques and tools and microbiology
http://nptel.ac.in/courses/104/105/104105102/ techniques in microbiology

Part D – Assessment and Evaluation

Suggested Continuous Evaluation Methods:

Internal Assessment	Marks	External Assessment	Marks
Class Interaction/ Quiz	**10**	**Viva Voice on Practical**	**15**
Attendance	**5**	**Practical Record File**	**10**
Assignments (Charts/ Model Seminar/ Rural Service/ Technology Dissemination/	**10**	**Table work/ Experiments** Major Exercise 20 marks, Two	**50**

Report of Excursion/ Lab Visits/ Survey/ Industrial Visit)		minor exercise 10 marks, spotting 10 marks	
TOTAL	**25**		**75**

Any remarks/suggestions: