B. Sc. Microbiology Program Objectives and Outcomes Program Objectives:

• To enrich students with knowledge and understanding of the different disciplines of Microbiology such as medical Microbiology, immunology, biochemistry, fermentation technology, environmental Microbiology, genetics, agricultural and food Microbiology, Wastemanagement.

• To make students learn advanced fields of microbiology such as Nanobiotechnology and Marinemicrobiology.

• To introduce the concepts of application and research in Microbiology and inculcate sense of scientific responsibilities.

• To help students build-up a progressive and successful career in Microbiology.

• To take a step ahead for the holistic development of students through activities like lectures from eminent personalities, Visits and variouscompetitions.

• It makes the student's competent enough to use Microbiology knowledge and skills to analyze problems involving microbes and undertake remedialmeasures.

• In addition, students are to be trained to use this knowledge in day-today applications and get a glimpse ofresearch.

• The students graduating in B.Sc. Microbiology degree must have thorough understanding the fundamentals of Microbiology as applicable to wide ranging contexts.

• They should have the appropriate skills of Microbiology so as to perform their duties asmicrobiologists.

• They must be able to analyze the problems related to Microbiology and come up with most suitablesolutions.

• As Microbiology is an interdisciplinary subject the students might have to take inputs from other areas of expertise. So the students must develop the spirit of team work.

Program Specific Objectives:

The B.Sc. Microbiology Program will enable the students;

PSOB-1.To learn basic concepts of amazing world of Microorganisms, Techniques in Microbiology, basics of Bacteriology, Cultivation and growth of Micro-

organisms.

PSOB-2. To understand concepts of Medical Microbiology, Epidemiology, Immunology, Bacterial Physiology, Fermentation Technology, Bacterial Genetics, Air, Water and Soil Microbiology.

PSOB-3.To strengthen the fundamentals of various fields of Microbiology.

PSOB-4. To develop scientific aptitude and motivate students to take up higher studies likeMSc microbiology and Research.

PSOB-5.To realize and appreciate the applicability of knowledge and Interdisciplinary approach in everyday life.

Program Specific Outcomes:

After successful completion of B.Sc. Microbiology Course, student will have:

PSOC-1.Understanding of Basic Concepts and Advanced knowledge of theory and practical courses in Microbiology.

PSOC-2.Subject knowledge to solve issues like bioremediation, Waste management and diagnostics.PSOC-3.Competency in laboratory safety and in routine and specialized microbiological laboratory skills.

PSOC-4.Motivation to involve in research activities, including accurately reporting observations and analysis.

M. C. E. Society's
Abeda Inamdar Senior College
Of Arts, Science and Commerce, Camp, Pune-1
(Autonomous) Affiliated to Savitribai Phule Pune University
NAAC accredited 'A' Grade

S.Y.B.Sc. Microbiology

2022-23 (CBCS – Autonomy 21 Pattern)

Course/ Paper Title	Immunology and Epidemiology
Course Code	21SBMB231
Semester	III
No. of Credits	2

Aims & Objectives of the Course

Sr. No.	Objectives
1.	To enrich students' knowledge and train them in epidemiology and Immunology
2.	To present to the students the concept of epidemiology, chemotherapy, drug resistance and immune system
3.	To inculcate sense of Scientific Responsibilities & Social Awareness
4.	To familiarize students with epidemiology and Immunology
5.	To introduce the basic concepts of epidemiology and Immunology

Expected Course Specific Learning Outcome

Sr. No.	Learning Outcome
1.	Students will be acquainted with the areas of Microbiology like epidemiology and Immunology
2.	Students will become aware about the role of Microbiologist in various fields of disease epidemiology and immunology
3.	Students will understand the Significance of epidemiological survey and understanding drug resistance and immune system

Syllabus

Unit No	Title with Contents	No. of Lectures
Credit I	**Medical Microbiology and Epidemiology**	18
1	Incubation period, Viability, Susceptibility, Pathogenicity, Virulence, Pathogenesis, Lab diagnosis of 1.Klebsiella 2 Bacillus 3.HIV	07
2	**Epidemiology** Definitions of Epidemic, Sporadic, Endemic, Pandemic 1. Aims and approaches of epidemiological studies. 2. .Epidemiology of infectious diseases i. Sources and Reservoirs of Infection ii. Modes of Transmission of Infections iii. Disease Prevention and Control Measures, 3. Distribution of disease with respect to time place and person	 01 01 03 02
3	**Introduction to Chemotherapy** 1.Classes ofantibiotics 2.Selective toxicity, Bioavailability, MIC, MBC,LD50 3.Antagonism and synergism in drugs 4.Concept of antibiotic sensitivity and drug resistance: (MDR,XDR,PDR)	04
Credit II	**Immunology**	(18)
1	**Immunity:** Definition, Types (Innate and acquired, active and passive, humoral and cell mediated)	3
2	**Formation of blood cells** (hematopoiesis): Myeloid and lymphoid lineages and differentiation process	3
4	**Immunohematology** 1. ABO and Rh blood group systems 2.Bombay blood group	6

	3.Biochemistry of blood group substances 4.Inheritance of ABH antigens 5.Medico- legal applications of blood groups	
5	**Active and Passive Immunization** 1.Active Immunization -Whole organismvaccines i. Attenuatedvaccines ii. InactivatedVaccines iii. Recombinantvaccines iv. Conjugatevaccines v. Subunitvaccine vi. Toxoids 2.Passive Immunization Transfer of preformed antibodies 3.Latest Immunization schedule in India	4

References

1. Kanungo Reba. (2017). Ananthanarayan and Paniker's Textbook of Microbiology. Tenth edition. The Orient Blackswan Publisher. ISBN-13:978-9386235251
2. Collins C. H., LyneP. M., Grange J. M. and Falkinham J. O. III. (Editors). (2004). Collins and Lyne's Microbiological Methods. 8th edition. Arnold, London;Oxford
3. Finch R., Greenwood D., Whitley R. and Norrby S. R. (2010) Antibiotic and Chemotherapy. 9th Edition. Elsevier. ISBN:9780702040641
4. Park K. (2019). Park's Preventive and Social medicine. 25th Edition. BanarsidasBhanot Publisher, Jabalpur. ISBN-13: 978-9382219156
5. Dey N. C., Dey T. K. and Sinha D. (2013). Medical Bacteriology Including Medical Mycology and AIDS. 17th Edition. New Central Book Agency (P) Ltd (Publisher). India
6. Kindt T. J., Goldsby R. A. and Osborne B. A. (2007). Kuby Immunology. 6thEd. W. H. Freeman and Co., New York.
7. MacFaddin J. F. (1985). Media for Isolation-Cultivation-Identification –Maintenance of Medical Bacteria. Vol. I. Williams and Wilkins,Baltimore
8. MacFaddinJ.F.(2000).Oxidation-FermentationTest.BiochemicalTestsfor the Identification of Medical Bacteria. 3rd ed. Philadelphia: Lippincott Wilkins and Williams. 379-387. B, III
9. Mukherjee K. L. and Ghosh S. (2010). Medical Laboratory Technology, Volume III: Procedure Manual for Routine Diagnostic Tests. 2nd edition. McGraw Hill Education(India) Private Limited. ISBN-13 : 978-1259061257
10. Mukred A. M., Hamid A. A., Hamzah A. and Wan Mohtar Wan Yusoff W. M. W. (2008). Growth Enhancement of Effective Microorganisms for Bioremediation of Crude Oil Contaminated Waters. Pakistan Journal of Biological Sciences.11: 1708-1712.Pathak S. S. and Palan V. (1997). Immunology-Essential and Fundamental, Pareen Publications Bombay
11. Public Health England. (2019). Oxidation/fermentation of glucose test.UK Standards for Microbiology Investigations. TP 27 Issue 4. 12. https://www.gov.uk/uk-standards-

formicrobiology-investigations-smi-quality-and-consistency-in-clinical-laboratories
12. Roitt Evan, Brostoff J., Male D. (1993) Immunology. 6th Edition.Mosby and Co. London.
13. RoittI. M. (1988).Essentials of Immunology, ELBS,London.
14. RoittM. (1984). Essentials of Immunology. P. G. Publishers Private Limited, NewDelhi.
15. Roth J. A., Bolin C., Brogden K. A., Chris Minion K. F. and Wannemuehler M. J. (1995). Virulence mechanisms of bacterial pathogens.Second edition.American Society for Microbiology. ISBN-13:978-1555810856
16. Schuenke S. (1997). Medical Microbiology.Fourth edition.University of Texas Medical Branch of Galvesion. Samuel Baron (Editor). ASIN:B008UYPLIO
17. Champoux J. J., Neidhardt F. C., Drew W. L. and Plorde J. J. (2004). Sherris Medical Microbiology: An Introduction to infectious diseases. 4th edition. Ryan K. J. andRay C.G. (Editors). McGraw-Hill Companies. DOI: 10.1036/0838585299
18. Shrivastava M., NavaidS., Peethambarakshan A., Agrawal K. and Khan A. (2015).Detection of rare blood group, Bombay (Oh) phenotype patients and management by acute normovolemichemodilution.Asian journal of transfusion science.**9**(1):74–77
19. Standards Unit. National Infection Service.PHE Bacteriology – Test Procedures.TP. 27(4): Issue date: 16.01.19.1-14
20. Stites D. P., Stobo J. D., Fudenberg H. H. and Wells J. V. (1982). Basic and Clinical Immunology.4th Edition.Lange Medical Publications, Maruzen Asia Pvt. Ltd., Singapore.
21. Gangal S. and Sontakke S. (2013). Textbook of Basic and Clinical Immunology.UniversitiesPressPrivatelimited.AvailablealsoatOrientblackswan,India.ISBN:9788173718298
22. Talwar G. P. (1983). Handbook of Immunology.Vikas Publishing Pvt. Ltd. New Delhi.
23. Paul W. E. (2003): Fundamental Immunology. 5th edition. Lippincott Williams and Wilkins Publishers. ISBN:9780781735148
24. Joklik W. K., Willett H. P., Amos D. B. and Wilfert C. M. 1995).Zinsser's Microbiology.20th Edition.Appleton and Lange Publisher. ISBN-13: 978-0838599839
25. Zajic J. E. and Supplisson B. (1972). Emulsification and degradation of “Bunker C” fuel oil by microorganisms. Biotechnol.Bioeng. 14:331-343.

M. C. E. Society's
Abeda Inamdar Senior College
Of Arts, Science and Commerce, Camp, Pune-1
(Autonomous) Affiliated to Savitribai Phule Pune University
NAAC accredited 'A' Grade

S.Y.B. Sc Microbiology

2022-23 (CBCS – Autonomy 21 Pattern)

Course/ Paper Title	Bacterial Physiology and Fermentation Technology
Course Code	21SBMB232
Semester	**III**
No. of Credits	2

Aims & Objectives of the Course

Sr. No.	Objectives
1.	To enrich students' knowledge and train them in Bacterial physiology and fermentationTechnology
2.	To make them learn different types of pathways in bacterial metabolism
3.	To introduce the concept of fermentation Technology, operation of fermenter its working and process control

Expected Course Specific Learning Outcome

Sr. No.	Learning Outcome
1.	Students will be acquainted with the different types of pathways in bacterial metabolism
2.	Students will learn diverse metabolic pathways followed by microorganisms for utilization of different substrates to run cell cycle
3.	Students will understand the importance of application of fermentation technology in large scale production of different microbial products

Syllabus

Sr.No.	Topic	No. of Lectures
Credit I	**Bacterial Physiology**	18
1	**Enzymes**	8
	i. Introduction to Enzymes: Properties of enzymes, Nature of active site, Structure of active site, commonly occurring amino acids at activesite.	1
	ii. Definitions of ribozymes, coenzymes, apoenzymes, prosthetic group and cofactors.	1
	iii. Nomenclature and classification as per IUB (upto class level)	2
	iv. Models forcatalysis– a. Lock andkey b. Inducedfit c. Transitionstate	1
	v. Effect of pH and temperature,substrate concentration and enzyme concentration, activators and inhibitors of enzyme	3
2	**Bacterial Physiology**	10
	i. Definitions of Metabolism, catabolism, anabolism, respiration andfermentation	1
	ii. Metabolic pathways (with structures) a.Embden Meyerhof Parnas pathway(Glycolysis) b.Hexose monophosphatepathway c.EntnerDoudoroffpathway d.Phosphoketolase pathway e.TCA cycle (with emphasis on amphibolism) and f.Glyoxylate bypass g.Homofermentative and heterofermentativepathway.	 2 2 1 1 2 1
Credit II	**Fermentation Technology**	18

1	**Concept of fermentation technology** i. Microbial biomass- based fermentation (Biofertilizer, biopesticide andProbiotics) Production of Primary metabolites (Organicacids, amino acids, vitamins and enzymes) iii. Production of Secondary metabolites(Antibiotics) iv. Production of recombinant products (insulin and growthhormones) v. Production of Fermented food products (Cheese,yoghurt) ii. Microbial biotransformation (Steroidtransformation)	
2	**Strains of industrially important microorganisms:** i. Desirable characteristics of industrialstrain ii. Principles and methods of primary and secondary screening iii. Master, working and seed culture; developmentof inoculum iv. Preservation and maintenance of industrialstrains.	5
3	**Design of a Fermenter (typical CSTR Continuous stirred Tank Reactor):** Different parts, their working and monitoring of different fermentation parameters (Temperature, pH, aeration, agitation, foam)	4
4	**Types of fermentations:** Batch, continuous and dual	2
6	**Media for industrial fermentations:** Constituents of media (Carbon source, nitrogen source, amino acids, vitamins, minerals, water, buffers, antifoam agents, precursors, inhibitors and inducers)	2
7	**Contamination:** Sources, precautions and consequences	1

References:

1. BIOTOL Series. (1993). Biotechnology by open learning series. Defense Mechanisms.Butterworth and Heinemann Ltd.,Oxford
2. CasidaL. E. J. R. (2016). Industrial Microbiology. New Age International Private Limited. ISBN-9788122438024
3. Conn E. E., Stumpf P. K., Bruening G., Doi R. Y. (1987). Outlines of Biochemistry. 5th Edition, John Wiley and Sons, New Delhi. (Unit I&II)
4. Madigan M. T., Martinko J. M. and Brock T. D. (2006). Brock's Biology of Microorganisms. Pearson Prentice Hall, Upper SaddleRiver.
5. Moat A. G. and Foster J. W. (1988). Microbial Physiology. 2nd Edition. John Wiley and Sons NewYork.
6. Nelson D. L. and Cox M. M. (2005). Lehninger's Principles of Biochemistry.8th edition. Mac Millan Worth Pub. Co. New Delhi.ISBN:9781319228002
7. Patel A. H. (2016). Industrial Microbiology. Trinity Press (Publisher). ISBN-13-9789385750267
8. Peppler H. L. and Perlman D. (1979). Microbial Technology. Volume 1: MicrobialProcesses. Academic Press, New York. ISBN:978-0-12-551501
9. Peppler H. L. and Perlman D. (1979). Microbial Technology. Volume II: Fermentation Technology (2nd Edition). Academic Press. ISBN:9781483268279
10. PrescottL.M.,HarleyJ.P.andKleinD.A.(2005).Microbiology.6th Edition. Mac Graw Hill Companies Inc. (Unit II)
11. Reed G. (Editor). (1982). Prescott and Dunn's Industrial Microbiology. Westport, CT, AVI Publishing CoInc.
12. Stanbury P. F., Whitaker A. and Hall S. J. (2016). Principles of Fermentation Technology.3rd Edition. Butterworth-Heinemann. ISBN:9780080999531
13. Voet D. and Voet J. G. (1995). Biochemistry. 2nd Edition. John Wiley & sons. New York. ISBN0-471-58651-X

M. C. E. Society's
Abeda Inamdar Senior College
Of Arts, Science and Commerce, Camp, Pune-1
(Autonomous) Affiliated to Savitribai Phule Pune University
NAAC accredited 'A' Grade

S.Y.B.Sc. Microbiology

2022-23 (CBCS – Autonomy 21 Pattern)

Course/ Paper Title	Practical: Practical Immunology and Bacteriology
Course Code	21SBMB233
Semester	III
No. of Credits	2

Aims & Objectives of the Course

Sr. No.	Objectives
1.	To make students aware about Antigen Antibody reaction
2.	To make them understand use of biochemical tests to identify microorganisms
3.	To introduce concept of Epidemiological survey
4.	To make them learn importance of microorganisms in various industries

Expected Course Specific Learning Outcome

Sr. No.	Learning Outcome
1.	Students will learn the various types of blood groups and its importance in blood transfusion
2.	Students will learn to identify micro-organisms
3.	Students will be acquainted with spread and control of various diseases via Epidemiological survey
4.	Students will understand how microorganisms will be used in industrially important products

Syllabus

Expt. No.	Topics	No. of Practicals
1	Blood grouping: ABO and Rh system.	**1**
2	**i. Biochemical characterization of bacteria.** 1.Sugar utilization test 2.Sugar fermentation test 3.Enzyme detection – Gelatinase, Catalase, Oxidase 4.Oxidative-fermentative test	**5**
3	**Study of Klebsiella – Gram staining and IMViC** **Study of Bacillus- Spore staining and amylase**	**2** **2**
4	**Primary screening of industrially important organisms:** i. Growth factor/ Antibiotic producing microorganisms by crowded plate technique. ii. Demonstration of parts and working of typical laboratory scale fermenter.	**2**
	TOTAL	**12**

References:

Experiment 1. Measurements of cell dimension by micrometry:-

1.Dubey R. C. and Maheshwari D. K. (2002). Practical Microbiology. S. Chand and Company Limited, New Delhi,India

2.Gunasekaran P. (2007). Laboratory Manual In Microbiology. New Age International(P) Limited New Delhi,India

3.Muskan K. and Patil U. K. (2009). Essentials of Biotechnology. I. K. International Publishing House Private Limited, New Delhi,India.

4.Saxena J., Baunthiyal M. and Ravi I. (2015). Laboratory Manual of Microbiology, Biochemistry and Molecular Biology. ScientificPublisher New Delhi, India

Experiment 2. Blood grouping:-

1.Godkar D. P. (2003).Textbook of Medical Laboratory Technology. Bhalani Publishing House, New Delhi,India.

2.Mukherjee K. L. (2013). Medical Laboratory Technology.Second Edtion.Volume III. McGraw-Hill Companies,India.

Experiment 3. I. a. Sugarutilization test:-

Minimal salt Medium (MSM with 1% sugar):

1.Mukred A. M., Hamid A. A., Hamzah A. and Wan Yusoff W. M. (2008). Enhancement of Biodegradation of Crude Petroleum-Oil in Contaminated Water by the Addition of Nitrogen Sources. Pakistan Journal of Biological Sciences, 11:2122-2127.

2.Mahalingam B. L., Karuppan M. and Manickam V. (2013). Optimization of Minimal Salt Medium for Efficient Phenanthrene Biodegradation by Mycoplana sp. MVMB2 Isolated from Petroleum Contaminated Soil Using Factorial Design Experiments. CLEAN - Soil, Air, Water. 41(1): 51–59. Wiley-VCH Verlag GmbH and Co. KGaA,Weinheim

Experiment 3. I. b. Sugar fermentation test:-

Phenol Red Broth Base:

1.Aneja K. R. (2007). Experiments in Microbiology, Plant Pathology and Biotechnology.New Age International, New Delhi, India

2.Dubey R. C. and Maheshwari D. K. (2002). Practical Microbiology. S. Chand and Company Limited, New Delhi,India

3.MacFaddin J. F. (2000). Biochemical Tests for Identification of Medical Bacteria. United Kingdom: Lippincott Williams andWilkins.

Experiment 3. I. c. Triple sugar Iron Agar:-

1.Jain A., Agarwal J. and Venkatesh V. (2018). Microbiology Practical Manual.1st Edition.E- Book. Elsevier Health Sciences,India.

2.MacFaddin J. F.(2000). Biochemical Tests for Identification of Medical Bacteria.UnitedKingdom:LippincottWilliams andWilkins.

3.Randhawa V. S., Mehta G. and Sharma K. B. (2009). Practicals and Viva in Medical Microbiology.Second Edition.Elsevier (A Division of Reed Elsevier India Pvt.Limited).

Experiment 3. I. d. IMViC:-

1.Dubey R. C. and Maheshwari D. K. (2002). Practical Microbiology. S. Chand and Company Limited, New Delhi,India

2.Jain A., Agarwal J. and Venkatesh V. (2018). Microbiology Practical Manual.1st Edition.E- Book. Elsevier Health Sciences,India.

3.Randhawa V. S., Mehta G. and Sharma K. B. (2009). Practicals and Viva in Medical Microbiology.Second Edition.Elsevier (A Division of Reed Elsevier India Pvt.Limited).

4.Verma A. S., Das S., and Singh A. (2014). Laboratory Manual for Biotechnology. S Chand and Company Limited, New Delhi,India

Experiment 3. I. e. Enzyme detection:-

1.Carroll K.C., Pfaller M. A., Landry M. L., McAdam A. J., Patel R., Richter S. S. and WarnockD. W. (Editors). (2019). Manual of Clinical Microbiology.2 Volume Set.12th Edition. John Wiley, USA

2.Dubey R. C. and Maheshwari D. K. (2002). Practical Microbiology. S. Chand and Company Limited, New Delhi,India

3.Goldman E. and Green L. H. (2008). Practical Handbook of Microbiology. United States: CRCPress.

4.Leber A. L. (2020). Clinical Microbiology Procedures Handbook. United States: Wiley.

5.Verhaegen J. and Heuck C. C . (Editors).(2003). Basic Laboratory Procedures in Clinical Bacteriology.Second Edition.Switzerland:World Health Organization.

Experiment 3. II. Isolation and identification of pathogens from clinical samples:-

1.MacFaddin J. F. (2000). Biochemical Tests for Identification of Medical Bacteria. United Kingdom:Lippincott Williams and Wilkins.

2.Randhawa V. S., Mehta G. and Sharma K. B. (2009). Practicals and Viva in Medical Microbiology.Second Edition.Elsevier (A Division of Reed Elsevier India Pvt.Limited).

3.Rosana Y., Matsuzawa T., Gonoi T. and Karuniawati A. (2014). Modified slide culture method for faster and easier identification of dermatophytes. Microbiology Indonesia. 8(3): 135-139https://doi.org/10.5454/mi.8.3.7

4.Verhaegen J. and Heuck C. C .(Editors). (2003). Basic Laboratory Procedures in Clinical Bacteriology.Second Edition.Switzerland:World Health Organization.

Experiment 4. Primary screening of industrially important organisms:-

1.Aneja K. R. (2007). Experiments in Microbiology, Plant Pathology and Biotechnology. New Age International, New Delhi,India

2.Dubey R. C. and Maheshwari D. K. (2002). Practical Microbiology. S. Chand and Company Limited, New Delhi,India

3.Gunasekaran P. (2007). Laboratory Manual in Microbiology.New Age International Private Limited, New Delhi,India.

4.Stanbury P. F., Whitaker A. and Hall S. J. (2016). Principles of Fermentation Technology.3rd Edition.Butterworth-Heinemann. ISBN:9780080999531

M. C. E. Society's
Abeda Inamdar Senior College
Of Arts, Science and Commerce, Camp, Pune-1
(Autonomous) Affiliated to Savitribai Phule Pune University
NAAC accredited 'A' Grade

Semester IV

S.Y.B.Sc Microbiology

2022-23 (CBCS – Autonomy 21 Pattern)

Course/ Paper Title	Bacterial Genetics
Course Code	21SBMB241
Semester	IV
No. of Credits	**2**

Aims & Objectives of the Course

Sr. No.	Objectives
1.	To enlighten the students with the basics of Genetics.
2.	To familiarize students with the detailed Chemical Structure of DNA with its functioning.
3.	To introduce the concept of Central dogma and flow of genetic information..
4.	To understand the basic concept of Mutations and its types.
5.	To relate structure and functions of Plasmid DNA in a bacterial cell.

Expected Course Specific Learning Outcome

Sr. No.	Learning Outcome
1.	Students will be conversant with the mechanism of Mutations and its types.
2.	Students will acquire basic knowledge of Central Dogma and flow of genetic information.
3.	The students will develop understanding about structure-function relationship in bio-molecules in case of Genomic DNA and Plasmid DNA.

Syllabus

Sr.No	Bacterial Genetics	No. of Lectures
Credit I	**Topic**	**18**
1	**Central Dogma and DNA as master molecule: Understanding hereditary molecule** i. Griffith'sexperiment ii. Avery and MacLeodMcCarthysexperiment iii. Gierer andSchramm experiment. iv. Fraenkel-Conrat and Singer experiment (TMV virus) v. Hershey and Chaseexperiment	5
2	**Detailed structure of DNA** i. Different forms of DNA(A,B, and Z) ii. Bonds involved in the stabilization of DNA structure iii. Organization of prokaryotic genome in the cell. iv. Concept of gene and central dogma	4
3	**Prokaryotic DNA replication** i. Models of DNA replication.(Conservative, semi-conservative and Dispersive) ii. Meselson and Stahl's experiment(semi-conservative) iii. Basic concept and mechanism of DNAreplication iv. Enzymes, proteins and other factors involved in the replication of bacterial DNA. v. Theta model of DNA replication.	6
4	**Gene expression** a.Concept of Genetic code and its properties b.Concept of transcription c.Concept of translation.	3
Credit II	**Topic**	**18**

1	**Mutations and reversions** Concept of Mutation and Types of mutations: Nonsense, Missense ,Silent, Conditional lethal-temperature sensitive, Amber, Reverse, suppressor i. Spontaneous Mutation • Concept of spontaneous mutation • Isolation of Mutants: Replica plate technique ii. Concept of Induced Mutations • Base pair substitution (Transitions,Transversions), Insertions and deletions-Frame shift mutations • Physical Mutagenic agent: UV and Xray • Chemical mutagenic agents • Base analogues (2amino purine,5bromouracil), • HNO2, Alkylating agents • Intercalating agents (EtBr, acridineorange)	12
2	**Plasmid genetics** i. Types of plasmids ii. Properties of Plasmid iii. Plasmid replication iv. Plasmid incompatibility v. Plasmid curing vi. Plasmid amplification Concept	6

References:

1. Brooker R. J. (2012). Genetics: Analysis and Principles. 4th edition. McGraw-HillPublication
2. Alberts B., Johnson A., Lewis J., Raff M., Roberts K. and Walter P. (2008). Molecular Biology of the Cell. 5th Edition. Garland Science. Taylor and Francis. ISBN: 978-0-8153-4105-5..
3. Gardner E. J., Simmons M. J. and Snustad D. P. (2006). Principles of Genetics. 8th edition. John Wiley and Sons Publication. ISBN-13:9788126510436.
4. Watson J.D., Baker, T.A., Bell, S.P., Gann A., Levine M. andLosick R. (2014).Molecular Biology of the gene.7th edition. Pearson. ISBN:

9780321762436

5. Pawar and Daginawala. General Microbiology. Vol. I and vol II. 1st Edition. Himalaya Publishing House,Mumbai
6. Primrose S. B. (2002) .Principles of Gene Manipulation. 6th Edition. Oxford: Blackwell ScientificPublications
7. Russel P. J. (2000). Fundamentals of Genetics. Publisher: Benjamin/CummingsISBN:9780321036261
8. Russel P. J. (2010). iGenetics: A Molecular Approach. 3rd Edition. Benjamin Cummings. ISBN:9780321569769
9. Stanier R. Y. (2003). General Microbiology. United Kingdom: Palgrave MacmillanLimited.
10. Strickberger M. W. (2012). Genetics. 3rdEdition. New Delhi:PHI LearningGardner

M. C. E. Society's
Abeda Inamdar Senior College
Of Arts, Science and Commerce, Camp, Pune-1
(Autonomous) Affiliated to Savitribai Phule Pune University
NAAC accredited 'A' Grade

Course/ Paper Title	Air, Water and Soil Microbiology
Course Code	21SBMB242
Semester	IV
No. of Credits	2

Aims & Objectives of the Course

Sr. No.	Objectives
1.	To enrich students' knowledge and train them in understanding air, water and soil Microbiology
2.	To make them learn different techniques to study air, water and soil microorganisms
3.	To introduce the concept of harmful and beneficial microorganisms present in different environments like air, water and soil and their effect on our day to day life

Expected Course Specific Learning Outcome

Sr. No.	Learning Outcome
1.	Students will be acquainted with the air, water and soil Microbiology
2.	Students will learn different techniques to cultivate micro-organisms from different environments like air, water and soil
3.	Students will understand effect of Microorganisms present in air, water and soil in our day to day life

Syllabus

Sr.No	Air, Water and Soil Microbiology	[36]
Credit I	**Air Microbiology and Water Microbiology**	**18**
1	**Air Microbiology**	8
	i. Airflora • Transient nature of airflora • Droplet, droplet nuclei and aerosols	1
	ii. Methods of Air sampling and types of airsamplers • Impaction onsolids • Impingement inliquid • Sedimentation • Centrifugation	4
	iii. Air sanitation: Physical and chemical methods.	2
	iv. Air borne infections	1
2	**Water Microbiology**	10
	i. Types of water: surface, ground, stored, distilled, mineral and de-mineralized water	1
	ii. Water purification methods	1
	iii. Water borne Infections	1
	iv. Indicators of faecal pollution: *Escherichia coli*, *Bifidobacterium*, *Streptococcus faecalis*, *Clostridium perfringens*, New indicators: *Campylobacter* and *Pseudomonas*	4

	v. Bacteriological analysis of water forpotability • Presumptive coliformcount • Confirmedtest • Completedtest • Eijkmantest • Membrane filtertechnique	3
Credit II	**Soil Microbiology**	18
	i. Rhizospheremicroflora and its role in therhizosphere	1
	ii. Role of microorganisms in composting and humus formation	2
	iii. Biofertilizers: Bacterial, Cyanobacterial and their large-scaleproduction	3
	iv. Biocontrol agents: Bacterial, Fungal and theirlarge-scale production	3
	v. Brief account of microbial interactions:Symbiosis, Neutralism, Commensalism,Competition, Ammensalism, Synergism, Parasitism and Predation	5
	vi. Role of microorganisms in elemental cycles innature: Carbon,Nitrogen	4

References:

1. Aithal S. C. and Kulkarni N. S. (2015). Water microbiology ~ an Indian perspective. Published by Himalaya Publishing House, IstEdition. ISBN: No.: 978- 93-5202-129-1.
2. Dube H. C. and Bilgrami K. S. (1976). Textbook of modern pathology.Vikas publishing house. NewDelhi.
3. Dubey R. C. and Maheswari D.K. Textbook of Microbiology. S. Chand Publishing. ISBN: 9788121926201
4. Frobisher M. (1974). Fundamentals of Microbiology. 9th Edition. Saunders, Michigan University Press. ISBN:9780721639222
5. Ingraham C. A. and Ingraham J. L. (2000). Introduction to Microbiology.United Kingdom: Brooks/Cole.
6. Lim D. V. (1989). Microbiology. 2nd Edition. West Publishing Company.ISBN:9780314262066

7. Madigan M. T., Thomas Brock T., Martinko J., Clark D. P. and Paul D. P. (2009). Brock's Biology of Microorganisms. Pearson/Benjamin Cummings. ISBN: 9780132324601
8. MartinA.(1977).AnIntroductiontoSoilMicrobiology.2nd edition.JohnWiley& Sons Inc. NewYork&London.
9. Martin A. Introduction to Soil Microbiology. (1961). John Wiley &Sons, New York and Londonpublication
10. MPCB, CPCB, BIS and WHO websites guidelines for drinking waterquality
11. Pawar C. B. and Daginawala H.F. (1982). General Microbiology. Vol. I and II. 1st Edition. Himalaya Publishing House, Mumbai. ISBN:9789350240892and ISBN9789350240908
12. Pelzar M. J., Chan E. C. S. and KriegN. R. (1986). Microbiology. 5th Edition. McGraw-HillPublication
13. Prescott L. M., Harley J. P. and Klein D. A. (2006). Microbiology. 6th Edition. McGraw Hill Higher Education. ISBN-13:978-0-07-295175-2
14. Rangaswami G. (1979) Recent advances in biological nitrogen fixation. Oxford and IBH. NewDelhi.
15. Salle A. J. (1971). Fundamental Principles of Bacteriology.7th Edition. Tata MacGraw Publishing Co.
16. Schlegel H. G. (1993). General Microbiology. 8thEdition. Cambridge University Press
17. Stanier R. Y. (2003). General Microbiology. United Kingdom: Palgrave MacmillanLimited.
18. SubbaRao N. S. (1977). Soil Microbiology. 4thEdition. Oxford and IBH Publishing Co. Pvt.Ltd.
19. Tortora G. J., Funke B. R. and Case C. L. (2016). Microbiology: Anintroduction 12th Edition, Pearson. ISBN-13:9780321929150

.

M. C. E. Society's
Abeda Inamdar Senior College
Of Arts, Science and Commerce, Camp, Pune-1
(Autonomous) Affiliated to Savitribai Phule Pune University
NAAC accredited 'A' Grade

S.Y.B.Sc Microbiology

2022-23 (CBCS – Autonomy 21 Pattern)

Course/ Paper Title	Practical: Genetics and Environmental Microbiology
Course Code	21SBMB243
Semester	IV
No. of Credits	2

Aims & Objectives of the Course

Sr. No.	Objectives
1.	To make students learn the importance of air microflora
2.	Students will understand the methods for testing potability of water
3.	Students will be acquainted with the beneficial effects of microorganisms in the field of agriculture
4	Students will learn the technique to isolate mutants

Expected Course Specific Learning Outcome

Sr. No.	Learning Outcome
1.	Students will learn the importance of air microflora and its diversity
2.	Students will understand the importance of testing potability of water
3.	Students will learn to prepare bioinoculants
4.	Students will be able to isolate mutants

	Practical: Genetics and Environmental Microbiology	
Expt. No.	**Topics**	**No. of Practicals**
1	**Air Flora:** i. Simpsonindex and Simpsons diversity index ii. Air settling velocitydetermination	2
2	**Bacteriological tests for potability of water** i. Presumptive test, Confirmed and Completedtest ii. Membrane filter technique(Demonstration)	3
3	**Enrichment, Isolation, Preparation and Application of Bioinoculants** i. *Azotobacter*species ii. *Rhizobium*species	4
4	i. Induction of mutations by using physical mutagen (e.g. U Vrays) ii. Isolation of antibiotic resistant mutants by Replica PlateTechnique iii. Demonstration of UV survivalcurve	3
	TOTAL	**12**

References:

Experiment no.2. Air Flora:

1. Aneja K. R. (2007). Experiments in Microbiology, Plant Pathologyand Biotechnology. New Age International, New Delhi,India
2. Cox C. C. and Wathes C. M. (2020). Bioaerosols Handbook. United States:CRC Press.
3. Saxena J., Baunthiyal M. and Ravi I. (2015). Laboratory Manual of Microbiology, Biochemistry and Molecular Biology. Scientific Publishers, Jodhpur,Rajasthan,India.
4. Verma A. S., Das S., and Singh A. (2014). Laboratory Manual for Biotechnology. S Chand and Company Limited, New Delhi,India

Experiment no.3. Bacteriological tests for potability of water

1. Aneja K. R. (2007). Experiments in Microbiology, Plant Pathologyand Biotechnology. New Age International, New Delhi,India
2. Atlas R. M. (1986; Digitized 2007). Basic and Practical Microbiology ,United Kingdom: Macmillan.

3. Dubey R. C. and Maheshwari D. K. (2002). Practical Microbiology. S. Chand and Company Limited, New Delhi,India
4. Nollet L. M. L. and De Gelder L. S. P. (2013). Handbook of Water Analysis, Third Edition. United States:Taylor andFrancis.

Experiment no. 4.

4.i. a) *Azotobacter*species:

1. Aneja K. R. (2007). Experiments in Microbiology, Plant Pathologyand Biotechnology. New Age International, New Delhi,India
2. Dubey R. C. and Maheshwari D. K. (2002). Practical Microbiology.S. Chand and Company Limited, New Delhi,India
3. Gunasekaran P. (2007). Laboratory Manual In Microbiology. New Age International(P) Limited New Delhi,India

4.i. b) *Rhizobium*species:

1. Aneja K. R. (2007). Experiments in Microbiology, Plant Pathologyand Biotechnology. New Age International, New Delhi,India
2. Dubey R. C. and Maheshwari D. K. (2002). Practical Microbiology.S. Chand and Company Limited, New Delhi,India
3. Gunasekaran P. (2007). Laboratory Manual In Microbiology. New Age International(P) Limited New Delhi,India

4.ii. Blue Green Algae (cyanobacteria):

1. Aneja K. R. (2007). Experiments in Microbiology, Plant Pathologyand Biotechnology. New Age International, New Delhi,India
2. Bisen P. S. (2014). Laboratory Protocols in Applied Life Sciences. United Kingdom: CRCPress.
3. Dubey R. C. and Maheshwari D. K. (2002). Practical Microbiology.S. Chand and Company Limited, New Delhi,India
4. Kumar V. (2012). Laboratory Manual of Microbiology. Scientific Publishers, Jodhpur, Rajasthan,India

Experiment no. 5. Induction of mutations:

1. Bisen P. S. (2014). Laboratory Protocols in Applied Life Sciences. United Kingdom: CRCPress.