



**FACULTY OF SCIENCES
DEPARTMENT OF ENGLISH**

COURSE: B.Sc. SEMESTER-III (All Sciences)

SUBJECT NAME: Communication Skills in English-I

SUBJECT CODE: 4SC03CSE2

Teaching & Evaluation Scheme:

Teaching hours/week				Credit	Evaluation Scheme/semester								
Th	Tu	Pr	Total		Theory				Practical				Total Marks
					Sessional Exam		University Exam		Internal		University		
					Marks	Hrs	Marks	Hrs	Pr	TW			
2	0	0	2	2	30	1.5	70	3	--	--	--	100	

Objectives:

- To develop them for Interpersonal Skills, with importance of Active Listening and Reading Non-Verbal Cues.
- To compete them in communication skills related to production and presentation of messages in multiple formats.
- To enable and demonstrate their critical thinking skills related to the analysis, interpretation, and criticism of messages.
- To litigate them in skills related to the construction and analysis of argumentation and persuasive discourse.
- To make them display an understanding of multiple theoretical perspectives and diverse intellectual traditions in Communication.
- To compete them in human relational interactions at work place.
- To make them viable to analysis and practice of ethical communication.
- To develop their feasibility for free expression and the responsibilities it entails.

Prerequisites:

- Students should have basic knowledge of English Language and grammar.
- Students should have ability to speak and write correct sentences in their day to day language.
- Students should be familiar with correct usage of language.

Course outline:

Unit No.	Content In Details Including Its Sub Topics	Minimum Number of Hours		
		Theor y	Practical	Total
	Section: A: Reading and Writing Skills			
01	Basic Concepts of Communication Meaning and objectives of communication Functions of communication Definitions of communication Process of communication Scope of communication	06	--	06



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02	Levels of Communication Intra Personal Communication Extra Personal Communication Inter Personal Communication Organizational Communication Mass Communication	03	--	03
03	Oral Communication Face to Face Discussion Telephone or Cellular Phone Lecture/ Seminar/ Conference / Presentation Interview Advantages and Disadvantages	02	--	02
04	Written Communication Letter E-mail Notice/circular/reports Advantages and Limitations of Written Communication	03	--	03
05	Non Verbal Communication Body Language Personal Appearance Postures (arms, handshake, hands in pocket, clenching of fist, sitting and standing postures) Gesture Facial Expression Eye Contact Paralanguage Pros and cons of Non-verbal Communication	04	--	04
06	Barriers to Communication and Steps to Overcome: Mechanical Barriers Socio-psychological Barriers Cultural Barriers Semantic Barriers Sender- oriented Barriers Receiver-oriented Barriers	04	--	04
07	Section: B Literature <i>The Old Man and the Sea</i> - Earnest Hemingway	08	--	08

Resources:

1. *Technical Communication: Principles and Practice*, **Meenaxi Raman and Sangeeta Sharma**, Oxford Press.
2. *Effective Personal Communication Skills for Public Relations*, **Green Andy**, Kogan Page Limited.
3. *Basic Business Communication*, **Flatly and Lesicar**.
4. *Technical Communication*, **D. K. Chakradev**, Tech-max publication.
5. *Basic Business Communication*, by **Flatly and Lesicar**.
6. *Prerequisites of Business Communication*, **Dr. M. N. Padia**, Self-Publication.
7. *Basic Communication Skills for Technology*, **Andrea J. Rutherford**, Pearson Education.



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FACULTY OF SCIENCES DEPARTMENT OF LIFE SCIENCES

COURSE: B.Sc.

SEMESTER: III

SUBJECT NAME: Microbial Physiology and Metabolism

SUBJECT CODE: 4SC03MPM1

Teaching & Evaluation Scheme:-

Teaching hours/week				Credit	Evaluation Scheme/semester							
Th	Tu	Pr	Total		Theory				Practical			Total Marks
					Sessional Exam		University Exam		Internal		University	
					Marks	Hrs	Marks	Hrs	Pr	TW		
4	0	4	8	6	30	1	70	3	30	-	70	200

Objectives:- The objective of this course is that the students can learn about microbial physiology and metabolism.

Prerequisites:- Basic knowledge of microbial physiology and metabolism.

Course content:-

Sr. No.	Course contents	Teaching Hours
1	Microbial Growth and Effect of Environment on Microbial Growth: Definitions of growth, measurement of microbial growth, Batch culture, Continuous culture, generation time and specific growth rate, synchronous growth, diauxic growth curve, Microbial growth in response to environment -Temperature (psychrophiles, mesophiles, thermophiles, extremophiles, thermodurics, psychrotrophs), pH (acidophiles, alkaliphiles), solute and water activity (halophiles, xerophiles, osmophilic), Oxygen (aerobic, anaerobic, microaerophilic, facultative aerobe, facultative anaerobe), barophilic. Microbial growth in response to nutrition and energy – Autotroph/Phototroph, heterotrophy, Chemolithoautotroph, Chemolithoheterotroph, Chemoheterotroph, Chemolithotroph, photolithoautotroph, Photoorganoheterotroph.	12
2	Nutrient uptake and Transport: Passive and facilitated diffusion, Primary and secondary active transport, concept of uniport, symport and antiport, Group translocation Iron uptake	10
3	Chemoheterotrophic Metabolism - Aerobic Respiration: Concept of aerobic respiration, anaerobic respiration and fermentation Sugar degradation pathways i.e. EMP, ED, Pentose phosphate pathway TCA cycle, Electron transport chain: components of respiratory chain, comparison of mitochondrial and bacterial ETC, electron transport phosphorylation, uncouplers and inhibitors.	16
4	Chemoheterotrophic Metabolism- Anaerobic respiration and fermentation: Anaerobic respiration with special reference to dissimilatory nitrate reduction (Denitrification; nitrate/nitrite and nitrate/ammonia respiration; fermentative nitrate reduction), Fermentation - Alcohol fermentation and Pasteur effect; Lactate fermentation (homofermentative and heterofermentative pathways), concept of linear	6



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	and branched fermentation pathways.	
5	Chemolithotrophic and Phototrophic Metabolism: Introduction to aerobic and anaerobic chemolithotrophy with an example each. Hydrogen oxidation (definition and reaction) and methanogenesis (definition and reaction), Introduction to phototrophic metabolism - groups of phototrophic microorganisms, anoxygenic vs. oxygenic photosynthesis with reference to photosynthesis in green bacteria, purple bacteria and cyanobacteria	10
6	Nitrogen Metabolism: an overview Introduction to biological nitrogen fixation, Ammonia assimilation, Assimilatory nitrate reduction, dissimilatory nitrate reduction, denitrification	6
Total Hours		60

Learning Outcomes:- The students are expected to Understand the microbial physiology and metabolism of microbes.

Teaching & Learning Methodology:-

- Use of audiovisual aids.
- Use of charts.
- Student interaction, group discussion, seminar, quizzes, assignment, brain storming session

Books Recommended:

1. Madigan MT, and Martinko JM (2014). Brock Biology of Microorganisms. 14th edition. Prentice Hall International Inc.
2. Moat AG and Foster JW. (2002). Microbial Physiology. 4th edition. John Wiley & Sons.
3. Reddy SR and Reddy SM. (2005). Microbial Physiology. Scientific Publishers India.
4. Gottschalk G. (1986). Bacterial Metabolism. 2nd edition. Springer Verlag.
5. Stanier RY, Ingrahm JI, Wheelis ML and Painter PR. (1987). General Microbiology. 5th edition, McMillan Press.



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PRACTICALS

S.No	Experiment
1	Study and plot the growth curve of <i>E. coli</i> by turbidometric and standard plate count methods.
2	Calculations of generation time and specific growth rate of bacteria from the graph plotted with the given data
3	Effect of temperature on growth of <i>E. coli</i>
4	Effect of pH on growth of <i>E. coli</i>
5	Effect of carbon and nitrogen sources on growth of <i>E.coli</i>
6	Effect of salt on growth of <i>E. coli</i>
7	Demonstration of alcoholic fermentation
8	Demonstration of the thermal death time and decimal reduction time of <i>E. coli</i> .



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FACULTY OF SCIENCES DEPARTMENT OF LIFE SCIENCES

COURSE: B.Sc.

SEMESTER: III

SUBJECT NAME: Microbial Genetics

SUBJECT CODE: 4SC03MIG1

Teaching & Evaluation Scheme:-

Teaching hours/week				Credit	Evaluation Scheme/semester								
Th	Tu	Pr	Total		Theory				Practical				Total Marks
					Sessional Exam		University Exam		Internal		University		
					Marks	Hrs	Marks	Hrs	Pr	TW			
4	0	4	8	6	30	1	70	3	30	-	70	200	

Objectives:- The objective of this course is that the students can learn about microbial Genetics.

Prerequisites:- Basic knowledge of microbial Genetics.

Course content:-

Sr. No.	Course contents	Teaching Hours
1	Genome Organization and Mutations: Genome organization: <i>E. coli</i> , <i>Saccharomyces</i> . Mutations and mutagenesis: Definition and types of Mutations; Physical and chemical mutagens; Molecular basis of mutations; Functional mutants (loss and gain of function mutants); Uses of mutations Reversion and suppression: True revertants; Intra- and inter-genic suppression; Ames test; Mutator genes	18
2	Plasmids: Types of plasmids – F plasmid, R Plasmids, colicinogenic plasmids, Ti plasmids, linear plasmids, yeast- 2 μ plasmid, Plasmid replication and partitioning, Host range, plasmid-incompatibility, plasmid amplification, Regulation of copy number, curing of plasmids	10
3	Mechanisms of Genetic Exchange: Transformation - Discovery, mechanism of natural competence Conjugation - Discovery, mechanism, Hfr and F' strains, Interrupted mating technique and time of entry mapping Transduction - Generalized transduction, specialized transduction, LFT & HFT lysates, Mapping by recombination and co-transduction of markers	12
4	Phage Genetics: Features of T4 genetics , Genetic basis of lytic <i>versus</i> lysogenic switch of phage lambda	8
5	Transposable elements : Prokaryotic transposable elements – Insertion Sequences, composite and non-composite transposons, Replicative and Non replicative transposition, Mu transposon,	12



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Eukaryotic transposable elements - Yeast (Ty retrotransposon), Drosophila (P elements), Maize (Ac/Ds) Uses of transposons and transposition	
Total Hours	60

Learning Outcomes:-

At the end of the course the student would have sufficient knowledge of Microbial Genetics

Teaching & Learning Methodology:-

- Use of audiovisual aids.
- Use of charts.
- Student interaction, group discussion, seminar, quizzes, assignment, brain storming session.

Books Recommended:

- 1) **Klug WS, Cummings MR, Spencer, C, Palladino, M** (2011). Concepts of Genetics, 10th Ed., Benjamin Cummings
- 2) **Krebs J, Goldstein E, Kilpatrick S** (2013). Lewin's Essential Genes, 3rd Ed., Jones and Bartlett Learning
- 3) **Pierce BA** (2011) Genetics: A Conceptual Approach, 4th Ed., Macmillan Higher Education Learning
- 4) **Watson JD, Baker TA, Bell SP et al.** (2008) Molecular Biology of the Gene, 6th Ed., Benjamin Cummings
- 5) **Gardner EJ, Simmons MJ, Snustad DP** (2008). Principles of Genetics. 8th Ed. Wiley-India
- 6) **Russell PJ.** (2009). *i* Genetics- A Molecular Approach. 3rd Ed, Benjamin Cummings



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PRACTICALS

S.No	Experiment
1	Preparation of Master and Replica Plates
2	Study the effect of chemical (HNO ₂) and physical (UV) mutagens on bacterial cells
3	Study survival curve of bacteria after exposure to ultraviolet (UV) light
4	Isolation of Plasmid DNA from <i>E.coli</i>
5	Study different conformations of plasmid DNA through Agarose gel electrophoresis.
6	Demonstration of Bacterial Conjugation
7	Demonstration of bacterial transformation and transduction
8	Demonstration of AMES test



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FACULTY OF SCIENCES **DEPARTMENT OF LIFE SCIENCES**

COURSE: B.Sc.

SEMESTER: III

SUBJECT NAME: SEMINAR

SUBJECT CODE: 4SC03SEM1

Teaching & Evaluation Scheme:-

Teaching hours/week				Credit	Evaluation Scheme/semester							
Th	Tu	Pr	Total		Theory				Practical		Total Marks	
					Sessional Exam		University Exam		Internal			University
				Marks	Hrs	Marks	Hrs	Pr	TW			
0	0	4	4	2					15	-	35	50

Learning Outcomes:- The students are expected to developing communication skill.



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DEPARTMENT OF LIFE SCIENCES

COURSE: B.Sc. SEMESTER: III

SUBJECT NAME: MICROBIAL METABOLISM

SUBJECT CODE: 4SC03MMB1

Teaching & Evaluation Scheme:-

Teaching hours/week				Credit	Evaluation Scheme/semester								
Th	Tu	Pr	Total		Theory				Practical				Total Marks
					Sessional Exam		University Exam		Internal		University		
					Marks	Hrs	Marks	Hrs	Pr	TW			
4	0	4	8	6	30	1	70	3	30	---	70	200	

Objectives:- The objective of this course is that the students can learn about microbial metabolism.

Prerequisites:- Basic knowledge of biological sciences.

Course content:-

Sr. No.	Course contents	Teaching Hours
1	Microbial Growth and Effect of Environment on Microbial Growth: Definitions of growth, Batch culture, Continuous culture, generation time and specific growth rate, effect of Temperature and pH. Effect of oxygen concentration on growth Nutritional categories of microorganisms	12
2	Nutrient uptake and Transport: Passive and facilitated diffusion, Primary and secondary active transport, concept of uniport, symport and anti-port, Group translocation, Iron uptake	10
3	Chemoheterotrophic Metabolism-Aerobic Respiration: Concept of aerobic respiration, anaerobic respiration and fermentation Sugar degradation pathways i.e.EMP, ED, Pentose phosphate pathway Electron transport chain: components of respiratory chain, comparison of mitochondrial and bacterial ETC, electron transport phosphorylation. TCA cycle,	16



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4	Chemoheterotrophic Metabolism-Anaerobic respiration and fermentation: Anaerobic respiration with special reference to dissimilatory nitrate reduction (Denitrification; nitrate/nitrite and nitrate/ammonia respiration; Fermentative nitrate reduction) Fermentation-Alcohol fermentation and Pasteur effect;Lactate fermentation(homo fermentative and hetero fermentative pathways),concept of linear and branched Fermentation pathways	6
5	Chemolithotrophic and Phototrophic Metabolism: Introductiontoaerobicandanaerobicchemolithotrophywithanexampleeach.Hydrog enoxidation (definition and reaction)and methanogenesis (definition and reaction) Introduction to phototrophic metabolism groups of phototrophic microorganisms, anoxygenic vs.oxygenic photosynthesis with reference to photo synthesis in green bacteria and cyanobacteria	10
6	Nitrogen Metabolism-an overview Introduction to biological nitrogen fixation, Ammonia assimilation, Assimilatory nitrate reduction	6
Total Hours		60

Learning Outcomes:-

At the end of the course the student would have sufficient knowledge of Microbial metabolism.

Teaching & Learning Methodology:-

- Use of audiovisual aids.
- Use of charts.
- Student interaction, group discussion, seminar, quizzes, assignment, brain storming session.

Books Recommended:

1. **Madigan MT, and Martinko JM**(2014). Brock Biology of Microorganisms. 14th edition. Prentice Hall International Inc.
2. **MoatAG and FosterJW**.(2002). Microbial Physiology. 4th edition. John Wiley & Sons



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3. **Reddy SR and Reddy SM.**(2005).Microbial Physiology.Scientific Publishers India
4. **Gottschal kG.**(1986).Bacterial Metabolism. 2nd edition. Springer Verlag
5. **Stanier RY, Ingrahm JI, Wheelis ML and Painter PR**(1987). General Microbiology. 5th edition, McMillan Press.
6. **WileyJM, SherwoodLM, and WoolvertonCJ.**(2013). Prescott's Microbiology. 9th edition.McGraw HillHigherEducation.



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PRACTICALS

S.No	Experiment
1	Study and plot the grow the curve of <i>E.coli</i> by turbidimetric and Standard Plate count methods
2	Calculations of generation time and specific growth rate of bacteria from the graph plotted with the given data
3	Effect of temperature on growth of <i>E.coli</i>
4	Effect of pH on growth of <i>E.coli</i>
5	Effect of Nitrogen and Carbon sources on <i>E.Coli</i>
6	Effect of salt on growth of <i>E.coli</i>
7	Demonstration of alcoholic fermentation
8	Demonstration of the thermal death time and decimal reduction time of <i>E.coli</i> .



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FACULTY OF SCIENCES DEPARTMENT OF LIFE SCIENCES

COURSE: B.Sc.

SEMESTER: III

SUBJECT NAME: MOLECULAR BIOLOGY

SUBJECT CODE: 4SC03MOB1

Teaching & Evaluation Scheme:-

Teaching hours/week				Credit	Evaluation Scheme/semester								
Th	Tu	Pr	Total		Theory				Practical				Total Marks
					Sessional Exam		University Exam		Internal		University		
					Marks	Hrs	Marks	Hrs	Pr	TW			
4	0	4	8	6	30	1	70	3	30	---	70	200	

Objectives:- The objective of this course is that the students can learn about microbial Genetics.

Prerequisites:- Basic knowledge of microbial Genetics.

Course content:-

Sr. No.	Course contents	Teaching Hours
1	Structures of DNA and RNA/Genetic Material: DNA structure, Salient features of double helix, Types of DNA, denaturation and renaturation, topo isomerases; Organization of DNA Prokaryotes , Viruses, Eukaryotes. RNA Structure	9
2	Regulation of gene Expression: Principles of transcriptional regulation, regulation at initiation with examples from <i>lac</i> and <i>trp</i> operons	5
3	Mutations: Mutations and mutagenesis: Definition and types of Mutations; Physical and chemical mutagens; Uses of mutations ,DNA repair mechanisms	4
4	Mechanisms of Genetic Exchange: Transformation-Discovery, mechanism of natural competence Conjugation-Discovery, mechanism , Hfr and F' strains Transduction-Generalized transduction, specialized transduction	8
5	Plasmids and Transposable Elements: Property and function of plasmids, Types of plasmids. Prokaryotic transposable elements–Insertion Sequences, composite and non-composite transposons , Replicative and Non replicative transposition, Uses of transposons and transposition.	4
Total Hours		30

Learning Outcomes:-

At the end of the course the student would have sufficient knowledge of Microbial Genetics

Teaching & Learning Methodology:-

- Use of audiovisual aids.
- Use of charts.



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- Student interaction, group discussion, seminar, quizzes, assignment, brain storming session.

Books Recommended:

1. **Watson JD ,Baker TA, Bell SP, Gann A, Levine M and LosickR(2008)**
Molecular Biology of the Gene,6th edition, Cold Spring Harbour Lab. Press, Pearson Publication
2. **Becker WM, Kleinsmith LJ, Hardin J and Bertoni GP (2009)** The World of the Cell,7th edition, Pearson Benjamin Cummings Publishing ,San Francisco
3. **DeRobertis EDP and DeRobertis EMF(2006)** Cell and Molecular Biology, 8th edition. Lippincott Williams and Wilkins, Philadelphia
4. **KarpG(2010)** Cell and Molecular Biology: Concepts and Experiments, 6thedition, John Wiley & Sons.Inc.
5. **SambrookJ and Russell DW.(2001)**. Molecular Cloning: A Laboratory Manual. 4thEdition, Cold Spring Harbour Laboratory press.
6. **Krebs J, Gold stein E, KilpatrickS (2013)**. Lewin's Essential Genes, 3rd Edition. Jones and Bartlett Learning
7. **Gardner EJ, Simmons MJ, Snustad DP(2008)**.Principles of Genetics.8thEd.Wiley-India
8. **Klug WS, Cummings MR, Spencer,C, Palladino,M(2011)**. Concepts of Genetics,10th Ed., Benjamin Cummings
9. **Maloy SR, CronanJE and FriefelderD(2004)** Microbial Genetics 2nd EDITION.,Jones and Barlett Publishers
10. **RussellPJ.(2009)**.iGenetics-A Molecular Approach.3rd Ed, Benjamin Cummings.



PRACTICALS

S.No	Experiment
1	Study of different types of DNA and RNA using micrographs and model/schematic representations
2	Study of semi-conservative replication of DNA through micrographs/schematic representations
3	Estimation of salmon sperm/calf thymus DNA using colorimeter(diphenylamine reagent)or UV spectrophotometer(A260 measurement)
4	Resolution and visualization of DNA by Agarose Gel Electrophoresis.
5	Resolution and visualization of proteins by Polyacrylamide Gel Electrophoresis(SDS-PAGE).
6	Study the effect of chemical (HNO ₂) and physical(UV) mutagens on bacterial cells
7	Study survival curve of bacteria after exposure to ultraviolet(UV)light
8	Demonstration of Bacterial Transformation and calculation of transformation efficiency.



FACULTY OF SCIENCES
DEPARTMENT OF LIFE SCIENCES

COURSE: B.Sc. SEMESTER: III

SUBJECT NAME: BIOFERTILIZERS AND BIOPESTICIDE

SUBJECT CODE: 4SC03BAB1

Teaching & Evaluation Scheme:-

Teaching hours/week				Credit	Evaluation Scheme/semester								
Th	Tu	Pr	Total		Theory				Practical				Total Marks
					Sessional Exam		University Exam		Internal		University		
					Marks	Hrs	Marks	Hrs	Pr	TW			
2	0	0	2	2	15	1	35	1.5	---	---	---	50	

Objectives:- The objective of this course is that the students can learn about microbial Genetics.

Prerequisites:- Basic knowledge of microbial Genetics.

Course content:-

Sr. No.	Course contents	Teaching Hours
1	Biofertilizers: General account of the microbes used as biofertilizers for various crop plants and their advantages over chemical fertilizers. Symbiotic N ₂ fixers: <i>Rhizobium</i> - Isolation, characteristics, types, inoculums production and field application, legume/pulses plants, <i>Frankia</i> -Isolation, characteristics, Alder, Casurina plants, non-leguminous crop symbiosis. Cyanobacteria, <i>Azolla</i> Isolation, characterization, mass multiplication, Role in rice cultivation, Crop response, field application.	10
2	Non-Symbiotic Nitrogen Fixers: Free living <i>Azospirillum</i> , <i>Azotobacter</i> -freeisolation, characteristics, mass inoculums, production.	4
3	Phosphate Solubilizers: Phosphate solubilizing microbes-Isolation, characterization, mass inoculum production, field application	4
4	Mycorrhizal Biofertilizers: Importance of mycorrhizal inoculum, types of mycorrhizae and associated plants, Mass inoculum production of VAM, field applications of Ectomycorrhizae and VAM.	5
5	Bioinsecticides: General account of microbes used as bio insecticides and their advantages over synthetic pesticides, <i>Bacillus thuringiensis</i> , production, Field applications, Viruses–cultivation and field applications.	7
Total Hours		30



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Learning Outcomes:-

At the end of the course the student would have sufficient knowledge of Microbial Genetics

Teaching & Learning Methodology:-

- Use of audiovisual aids.
- Use of charts.
- Student interaction, group discussion, seminar, quizzes, assignment, brain storming session.

Books Recommended:

1. **Kannaiyan , S.**(2003).Bioetchnology of Biofertilizers, CHIPS, Texas.
2. **MahendraK.Rai**(2005).Handbook of Microbial biofertilizers, The Haworth Press, Inc.NewYork.
3. **Reddy, S. M.et.al.** (2002). Bioinoculants for sustain able agriculture and forestry, Scientific Publishers.
4. **Subba Rao N.S** (1995) Soil microorganisms and plant growth Oxford and IBH publishing co.Pvt. Ltd. NewDelhi.
5. **SaleemF and ShakooriAR**(2012) Development of Bioinsecticide, Lap Lambert Academic Publishing GmbHKG
6. **Aggarwal SK**(2005) Advanced Environmental Biotechnology, APH publication.



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FACULTY OF SCIENCES DEPARTMENT OF LIFE SCIENCES

COURSE: B.Sc. SEMESTER: III
SUBJECT NAME: MICROBIOLOGICAL ANALYSIS OF AIR AND WATER
SUBJECT CODE: 4SC03MAW1

Teaching & Evaluation Scheme:-

Teaching hours/week				Credit	Evaluation Scheme/semester								
Th	Tu	Pr	Total		Theory				Practical				Total Marks
					Sessional Exam		University Exam		Internal		University		
					Marks	Hrs	Marks	Hrs	Pr	TW			
2	0	0	2	2	15	1	35	1.5	---	---	---	50	

Objectives:- The objective of this course is that the students can learn about microbiological analysis of air and water.

Prerequisites:- Basic knowledge of biological sciences.

Course content:-

Sr. No.	Course contents	Teaching Hours
1	Aero microbiology: Bio aerosols, Airborne microorganisms (bacteria ,Viruses, fungi) and their impact on human health and environment, significance in food and pharma industries and operation theatres, allergens	4
2	Air Sample Collection and Analysis: Bio aerosol sampling, air samplers, methods of analysis, CFU, culture media for bacteria and fungi, Identification characteristics	7
3	Control Measures: Fate of bio aerosols, inactivation mechanisms–UV light, HEPA filters, desiccation, Incineration	4
4	Water Microbiology: Water borne pathogens, water borne diseases	4
5	Microbiological Analysis of Water: Sample Collection, Treatment and safety of drinking (potable) water, Methods to detect potability of water samples:(a) Standard Qualitative procedure: presumptive / MPN tests, confirmed and completed tests for faecal coli forms (b)Membrane filter technique and (c)Presence/absence tests	7
6	Control Measures: Precipitation, chemical disinfection, filtration, high temperature, UV light	4
Total Hours		30



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Learning Outcomes:-

At the end of the course the student would have sufficient knowledge of Microbes present in air and water and their analytical techniques.

Teaching & Learning Methodology:-

- Use of audiovisual aids.
- Use of charts.
- Student interaction, group discussion, seminar, quizzes, assignment, brain storming session.

Books Recommended:

1. **daSilvaN, Taniwaki MH, JunqueiraVC, SilveiraN, NascimentoMS, GomesRAR**(2012) Microbiological Examination Methods of Food and Water A Laboratory Manual, CRC Press.
2. **AtlasR Mand BarthaR.**(2000). Microbial Ecology: Fundamentals & Applications. 4th edition. Benjamin/Cummings Science Publishing, USA.
3. **MaierRM, PepperIL and GerbaCP.**(2009).Environmental Microbiology.2ndedition, Academic Press.
4. **HurstCJ, CrawfordRL, GarlandJL, LipsonDA**(2007) Manual of Environmental Microbiology, 3rdedition, ASMpress