

GUJARAT VIDYAPITH : AHMEDABAD
Faculty of Science and Applied Science
Department of Biogas Research and Microbiology
BSc. Semester-II
MIC -201 Basic Bacteriology

(Syllabus of theoretical portion) (In force from June, 2023)
 (External Evaluation: 60% + Internal Evaluation: 40%)
 (Total Teaching Hours=30, Credit=02)

LEARNING OUTCOMES

After studying this paper student will be able to.....

- Get Knowledge regarding Prokaryotes, and different systems of classification of bacteria
- Understand cellular organization of bacterial cell and external structures of bacterial cell
- Get knowledge regarding nutritional diversities and diversified nutritional requirements of bacteria
- Learn the basic skills of cultivation techniques of bacteria and also get the techniques of media preparation in laboratory
- Know about Pure culture techniques and maintenance and preservation

Unit 1:	Cellular Organization and External Structures of Bacterial cell	Teaching Hours: 08
	➤ Cellular organization: size, shape and arrangement of bacterial cells	2.5 Hours
	➤ External structures of bacterial cell	
	• Structure and chemical composition of cell wall of Gram-positive and Gramnegative bacteria / Archaeobacteria, Acid fast bacteria	2 Hours
	• Cell wall less bacteria, protoplast, spheroplast	0.5 Hour
	• Flagella of Gram-positive bacteria and Gram-negative bacteria , endo-flagella (axial filaments), bacterial motility	1 Hour
	• Capsules, slime layer, pili and fimbriae, sheaths, prosthecae and stalks	2 Hours
Unit 2:	Internal Structures of Bacterial cell	Teaching Hours: 07
	➤ Cytoplasmic membrane of Eubacteria and Archaeobacteria	1 Hour

	➤ Structural differences between eubacteria and archaebacteria	10 minutes
	➤ Mesosomes	0.5 Hour
	➤ Cytoplasm and nuclear material (bacterial chromosome), bacterial plasmids	1..5 Hours
	➤ Ribosomes of Eubacteria and Archaebacteria	1 Hour
	➤ Inclusion bodies (cellular reserve food materials)	50 minutes
	➤ Bacterial spores and cyst: spore structure, types of spores, sporogenesis and germination of spore, bacterial cyst	2 Hours
Unit 3:	Nutrition and Cultivation of Bacteria	Teaching Hours: 08
	➤ Nutritional and chemical requirements of bacteria: carbon, oxygen, nitrogen, sulfur, phosphorus, trace elements, vitamins, growth factors, water	1 Hour
	➤ Nutritional diversities in bacteria • Based on source of energy: Phototrophs, Chemotrophs	1 Hour
	• Based on source of electron donor: Lithotrophs, Organotrophs	1.5 Hours
	• Based on source of carbon: Autotrophs, Heterotrophs, Mixotrophs, Obligate parasites	1.5 Hours
	➤ Culture media: media ingredients, preparation of media, general cultivation media (N.broth and N.agar)	2 Hours
	➤ Cultivation of anaerobic bacteria	1 Hour
Unit 4:	Pure Culture Techniques	Teaching Hours: 07
	➤ Pure culture, mixed culture, selective methods to obtain pure cultures: chemical, physical, and biological methods	1.5 Hours
	➤ Isolation methods of pure culture: aseptic technique, streak plate, spread plate and pour plate techniques	1.5 Hours
	➤ Cultural characteristics: colony characteristics, characteristics of broth cultures	1.5 Hours
	➤ Maintenance and preservation of pure cultures	2 Hour
	➤ Culture collection centers and their role	0.5 Hour

REFERENCES

No.	Name	Author
1.	Microbiology	Pelczar JR., Chan ECS, Krieg NR, 5th Edition (1993), McGraw-Hill Book Company, NY.
2.	Principles of Microbiology	R. M. Atlas, 2 nd Edition (Indian Edition) (2015) McGraw Hill Education (India) Private Limited, New Delhi, India
3	Microbiology,	Prescott L, Harley J P, and Klein D A, (2008), Microbiology, 7th edn. Wm C. Brown - McGraw Hill, Dubuque, IA.7th edn.

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BSc. Semester-II
MIC -201 Basic Bacteriology

(Syllabus of Practical portion) (In force from June, 2023)
 (External Evaluation: 60% + Internal Evaluation: 40%)
 (Total Teaching Hours=60, Credit=02)

LEARNING OUTCOMES:

After performing following practicals student will be able to.....

- Know the skill regarding broth, agar slant, agar plate cultivation techniques for bacteria
- Know the anaerobic bacteria cultivation techniques
- Understand the different Bacterial cultures preservation technique in laboratory
- Will get knowledge regarding pigmented bacteria
- Will get information on different structures of bacterial cell through different structural staining techniques

No.	Practical	Teaching Hours
1	Preparation of bacteriological media: Nutrient broth and Nutrient agar	4 Hours
2	Cultivation and isolation of bacteria	8.5 Hours
	a) Broth culture method	2 Hours
	b) Agar plate methods:	
	<input type="checkbox"/> Streak plate method	2 Hours
	<input type="checkbox"/> Pour plate method	2 Hours
	<input type="checkbox"/> Spread plate method	2 Hours
	[Method: Gram's stain of mixed bacterial culture, isolation of bacteria, colony (cultural) characteristics, morphological characteristics (Gram's stain)	
	c) Agar slant (slope) method for pure culture	0.5 Hour
3	Cultivation of anaerobic bacteria by use of	3 Hours
	a. Robertson's cooked meat media	1 Hour
	b. Thioglycollate broth	1 Hour
	c. Anaerobic jar (Demonstration)	1 Hour
4	Preservation of microbial cultures	2 Hours

	a) Periodic sub culturing and storage at refrigeration temperature b) Preservation of bacteria in soil (nitrogen fixers)	1 hour 1 hour
5	Study of pigmented bacteria a. <i>Staphylococcus aureus</i> b. <i>Staphylococcus epidermidis</i> c. <i>Micrococcus luteus</i> d. <i>Serratia marscescens</i> e. <i>Pseudomonas aeruginosa</i>	2.5 Hours 0.5 Hour 0.5 Hour 0.5 Hour 0.5 Hour 0.5 Hour
6	Differential staining of bacteria: Gram stain method	5.5 Hours
7	Study of bacterial structure by structural staining a. Endospore by Dorner's method b. Cell wall by Dyar's method c. Capsule by Hiss's method d. Granule by Albert's method	16 Hours 4 Hours 4 Hours 4 Hours 4 Hours
8	Use of special staining technique to study bacteria a. Spirocheates by Fontana's method	4 Hours
9	Study of effect of various physical agents on growth of bacteria a. Effect of pH b. Effect of temperature c. Effect of osmotic pressure (NaCl and Sucrose)	4.5 Hours 1.5 Hours 1.5 Hours 1.5 Hours

Scheme of Practical Examination

Ex.1	Isolation of bacteria by streak plate method	15
Ex.2	Structural and special staining of bacteria (anyone) a) Endospore staining by Dorner's method b) Cell wall staining by Dyar's method c) Capsule staining by Hiss's method d) Metachromatic granule staining by Albert's method e) <i>Spirochaetes</i> staining by Fontana's method	15
Ex- -3	Spotting	15
Ex-4	Viva voce	10
Ex.5	Journal and slides	05
Total Marks		60

Board of Studies (Microbiology)

No.	Name	Member	Signature
1	Dr.S.R.Dave	External Member	
2	Dr.Devyani Tipre	External Member	
3	Dr.Nikhil Bhatt	Internal Member	
4	Dr. Srinivas Duggirala	Internal Member	
5	Dr. Pratik Shilpaka	Internal Member	
6	Dr. Niraj Seth	Internal Member	
7	Mrs.Preeti Shukla	Internal Member	
8	Mr.Arvind Dungarachiya	Internal Member	

GUJARAT VIDYAPITH : AHMEDABAD
Faculty of Science and Applied Science
Department of Biogas Research and Microbiology
B.Sc. Semester-II
Minor Course: CHEM-201: Inorganic Chemistry
(Syllabus of theoretical portion) (In force from June, 2023)
(External Evaluation: 60% + Internal Evaluation: 40%)
(Total Teaching Hours=30, Credit=02)

Learning Outcomes:

After studying this paper student will be able to.....

- * know the electronic configuration and occurrence of s-, p-, and d-blocks elements
- * understand the general trends in the chemistry of s-, p- and d-blocks elements

- * describe the trends in physical and chemical properties of group 1, 2, 13 to 18 elements

- * know the allotropes of carbon, phosphorus and sulphur

- * list the important uses of alkali and alkaline earth metals, boron, aluminium, nitrogen, oxygen, ozone, sulphur dioxide and noble gases

- * explain anomalous properties of the first element of each group

- * know oxidation states, Magnetic properties, colour and absorption spectra of d-blocks elements

Note: Each unit must be given equal weightage in examinations

Unit-1(A): s- Block Elements (Alkali and Alkaline earth metals) (10Hours)

Group-1: Alkali metals

- 1(A).1 General introduction, electronic configuration, occurrence **(1 hour)**
- 1(A).2 Anomalous properties of the Lithium **(0.5 hour)**
- 1(A).3 Diagonal Relationship between Lithium and Magnesium **(0.5 hour)**
- 1(A).4 Trends in the variation of properties (such as ionization enthalpy, atomic and ionic radii) **(1 hour)**
- 1(A).5 Trends in chemical reactivity with oxygen, water, hydrogen and halogens **(1 hour)**
- 1(A).6 Biological importance of sodium and potassium **(0.5 hour)**
- 1(A).7 Uses of Alkali metals **(0.5 hour)**

Group-2: Alkaline earth metal

- 1(A).8 General introduction, electronic configuration, occurrence **(1 hour)**
- 1(A).9 Anomalous properties of the Beryllium **(0.5 hour)**
- 1(A).10 Diagonal Relationship between Beryllium and Aluminium **(0.5 hour)**
- 1(A).11 Trends in the variation of properties (such as ionization enthalpy, atomic and ionic radii) **(1 hour)**
- 1(A).12 Trends in chemical reactivity with oxygen, water, hydrogen and halogens **(1 hour)**
- 1(A).13 Biological importance of Mg and Ca **(0.5 hour)**
- 1(A).14 Uses of Alkaline earth metals **(0.5 hour)**

Unit-1(B):d-Block Elements Transition Elements (First, second and third Transition Series) (5 Hours)

- 1(B).1 General introduction, electronic configuration (1 hour)
- 1(B).2 Physical properties of transition metals (0.5 hour)
- 1(B).3 Variation in Atomic and Ionic Sizes of Transition Metals (1 hour)
- 1(B).4 Ionisation Enthalpies of Transition Metals (0.5 hour)
- 1(B).5 Oxidation states of Transition Metals (0.5 hour)
- 1(B).6 Magnetic Properties of Transition Metals (0.5 hour)
- 1(B).7 Formation of coloured ions (0.5 hour)
- 1(B).8 Catalytic properties of Transition Metals (0.5 hour)

References

1. Basic Inorganic Chemistry (Third edition), F.Albert cotton, Geoffrey Wilkinson and Paul L.Gaus., John Wiley and Sons,Inc.,New York., pp.73-124 (1995) .
2. Concise Inorganic Chemistry (Fifth edition), J.D.Lee., Blackwell Science Ltd.,Oxford., pp.-72-110(1996) .
3. Atkins, P.W.; Overton, T.L.; Rourke, J.P.; Weller, M.T.; Armstrong, F.A. , Inorganic Chemistry, 5th Edition, W. H. Freeman and Company(2010).

Unit-2: p-Block Elements (15Hours)

- 2.1 General Introduction to p-Block Elements (0.5 hour)

Group 13 elements : Boron Family

- 2.2 General introduction, electronic configuration, occurrence (0.5 hour)
- 2.3 Anomalous properties of the Boron (0.5 hour)
- 2.4 Trends in the variation of properties (such as ionization enthalpy, atomic and ionic radii, electronegativity) (0.5 hour)
- 2.5 Physical properties and chemical reactivity (with air, acids, alkalies and halogens) (0.5 hour)
- 2.6 Uses of boron, aluminium and their compounds (0.5 hour)

Group 14 elements : Carbon Family

- 2.7 General introduction, electronic configuration, occurrence (0.5 hour)
- 2.8 Anomalous properties of the carbon (0.5 hour)
- 2.9 Trends in the variation of properties (such as ionization enthalpy, atomic and ionic radii, electronegativity) (0.5 hour)
- 2.10 Physical properties and chemical reactivity (with oxygen, water and halogens) (0.5 hour)
- 2.11 Allotropes of carbon (Diamond, Graphite and Fullerenes) and Uses of carbon (0.5 hour)

Group 15 elements : Nitrogen Family

- 2.12 General introduction, electronic configuration, occurrence (0.5 hour)
- 2.13 Anomalous properties of the Nitrogen (0.5 hour)
- 2.14 Trends in the variation of properties (such as ionization enthalpy, atomic and ionic radii, electronegativity) (0.5 hour)
- 2.15 Physical properties and chemical reactivity (with hydrogen, oxygen, halogens and metals) (0.5 hour)
- 2.16 Uses of nitrogen and allotropes of Phosphorus (White, Red and Black) (0.5 hour)

Group 16 elements : Oxygen Family

- 2.17 General introduction, electronic configuration, occurrence **(0.5 hour)**
- 2.18 Anomalous properties of the Oxygen **(0.5 hour)**
- 2.19 Trends in the variation of properties (such as ionization enthalpy, electron gain enthalpy, atomic and ionic radii, electronegativity) **(0.5 hour)**
- 2.20 Physical properties and chemical reactivity (with hydrogen, oxygen and halogens) **(0.5 hour)**
- 2.21 Allotropes of Sulphur (Rhombic, Monoclinic) **(0.5 hour)**
- 2.22 Uses of oxygen, ozone, sulphur dioxide and sulphuric acid **(0.5 hour)**

Group 17 elements : Halogen Family

- 2.23 General introduction, electronic configuration, occurrence **(0.5 hour)**
- 2.24 Anomalous properties of the Fluorine **(0.5 hour)**
- 2.25 Trends in the variation of properties (such as ionization enthalpy, electron gain enthalpy, atomic and ionic radii, electronegativity) **(0.5 hour)**
- 2.26 Physical properties and chemical reactivity (with hydrogen, oxygen, metals and other halogens) **(0.5 hour)**

Group 18 elements : Noble gas Family

- 2.27 General introduction, electronic configuration, occurrence **(0.5 hour)**
- 2.28 Trends in the variation of properties (such as ionization enthalpy, electron gain enthalpy, atomic and ionic radii) **(0.5 hour)**
- 2.29 Physical properties and chemical reactivity**(0.5 hour)**
- 2.30 Uses of noble gases**(0.5 hour)**

References

1. Basic Inorganic Chemistry (Third edition), F.Albert cotton, Geoffrey Wilkinson and Paul L.Gaus., John Wiley and Sons,Inc.,New York., pp.73-124 (1995) .
2. Concise Inorganic Chemistry (Fifth edition), J.D.Lee., Blackwell Science Ltd.,Oxford., pp.-72-110(1996) .
3. Shriver, D.D.; Atkins, P.; Langford, C.H., Inorganic Chemistry 2nd Ed., Oxford University Press(1994).

Board of Studies(Chemistry)

(1) Prof.(Dr.) Niraj Sheth

(3) Dr. Hitesh K. Kadiya

(2) Dr. Sanjay D. Patel

(4) Prof.(Dr.) Mayur C.Shah

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Faculty of Science and Applied Science
Department of Biogas Research and Microbiology
B.Sc. Semester-II
Minor Course: CHEM-201: Inorganic Chemistry
(Syllabus of practical portion) (In force from June, 2023)
(External Evaluation: 60% + Internal Evaluation: 40%)
(Total Teaching Hours=60, Credit=02)

Learning Outcomes:

After performing following practicals student will be able to.....

- detect the positive and negative ions in inorganic mixture by dry test
- detect the positive and negative ions in inorganic mixture by wet test

Qualitative analysis of inorganic mixture (60 hours)

Semi-micro method of analysis of mixture of powders containing four radicals excluding soluble PO_4^{3-} , arsenite, arsenate and borate. Mixture may be partly soluble in water and wholly soluble in an acid

Candidate should perform the analysis of following ions

Na^+ , K^+ , NH_4^+ , Mg^{2+} , Ba^{2+} , Sr^{2+} , Ca^{2+} , Fe^{2+} , Fe^{3+} , Al^{3+} , Cr^{3+} , Zn^{2+} , Mn^{2+} , Co^{2+} , Hg^{2+} , Pb^{2+} , Cu^{2+} , Sn^{2+} , Ag^+ and S^{2-} , SO_3^{2-} , SO_4^{2-} , CO_3^{2-} , Cl^- , Br^- , I^- , NO_3^- , NO_2^-

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GUJARAT VIDYAPITH, AMADAVAD
FACULTY OF SCIENCE AND APPLIED SCIENCE
BIOGAS RESEARCH AND MICROBIOLOGY DEPARTMENT
SEMESTER 2
PHY-201 PHYSICS II

(Syllabus of theoretical portion) (In Force from June 2023)

Total marks: 100

(Internal evaluation: 40 Marks + External evaluation: 60 Marks)

Total teaching hours: 45hr, Credit =03+1.5)

Learning outcomes

On successful completion of the course students will be able to:

- To learn about Phenomenon of light
- To understand the properties of light energy
- Familiarize with general terms in acoustics like intensity, loudness, reverberation etc, and study in detail about production, detection, properties and uses of ultrasonic waves.
- To learn various electronic components and it's testing

UNIT 1	OPTICS Interference <ul style="list-style-type: none">• Principle of super position• Interference of light• Types of interferences DIFFRACTION <ul style="list-style-type: none">• Diffraction• Types of diffraction• Difference between diffraction and interferences RESOLVING POWER OF OPTICAL INSTRUMENTS <ul style="list-style-type: none">• Resolution, Resolving power and Rayleigh's criterion• Resolving power of Prism• Plane diffraction grating- Resolving power of Plane	12hrs
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diffraction grating

- Introduction of optical instruments (Spectrometer, Simple Microscope, Compound Microscope)

References: ❖ Optics and atomic Physics by D. P. Kandelval, Himalaya Publishing house
❖ Optics by Ajoy Ghatak (TMH edition)
❖ Engineering Physics By R. K. Gaur and S. L. Gupta

UNIT 2

SOUND

11hrs

Sound wave:

- Introduction, Intensity & its level,
- Loudness & pitch
- Radiation efficiency of a sound source
- Newton's formula and Laplace's correction

Ultrasonic:

- Introduction,
- Piezo electric effect
- Piezo electric oscillator
- Applications of ultrasonic waves

References: ❖ Mechanics, Wave motions & Heat by Francis Weston Sears, (Addison Wesley Publication)
❖ A Text book of oscillations, wave & acoustics by M Ghosh, D. Bhattacharya, S. Chand publication
❖ Engineering Physics By R. K. Gaur and S. L. Gupta

UNIT 3

Microscope:

11hrs

Light Microscope: Types of optical light microscopes, Optical system and the optic principle of the Light Microscope, Working of an optical Light Microscope, Bright Field Microscopy, Phase Contrast Microscopy, Fluorescence Microscope.

References: ❖ Engineering Physics By R. K. Gaur and S. L. Gupta

UNIT 4

ELECTRONIC COMPONENTS AND ITS MEASUREMENTS

11hrs

- Diodes, its characteristics and measurements
- Resistor, resistance and resistivity
- Capacitor, capacitance
- Inductor, Inductance
- Transformer and its types

- Multimeter
- Regulated D.C. power supply
- Transistors (BJT, UJT)

References: ❖ A text book of Oscillation, Wave & Acoustics By M. Ghosh, D. Bhattacharya (S. Chand)

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SEMESTER 2
PHY-201 PHYSICS II

(Syllabus of Practical portion) (In Force from June 2023)

Total marks: 100

(Internal evaluation: 40 Marks + External evaluation: 60 Marks)

Total practical hours: 45hr, Credit =1.5)

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1. To determine the resolving power of prism.
 2. To determine Cauchy's constant A and B using given formula and also find out with graph.
 3. To determine the wavelength of sodium light using plane diffraction grating.
 4. Find out the refractive index of different liquids using convex lens.
 5. To study nuclear radioactive decay using simulation.
 6. To use a multimeter for measuring (a) resistance, (b) AC & DC voltages (c) DC current (d) capacitance (e) temperature
 7. Regulated D.C. power supply
 8. To determine the value of capacitors.
 9. To study the decay of capacitor.
 10. To determine the value of inductor

GUJARAT VIDYAPITH : AHMEDABAD
Faculty of Science and Applied Science,
Department of Biogas Research and Microbiology
BSc. Semester-II
Skill Enhancement (Physico-chemical analysis of soil and water)
(Syllabus of practical portion) (In force from June, 2023)
(External Evaluation: 60% + Internal Evaluation: 40%)
(Total Hours=75, Credit=2.5)

PHYSICO-CHEMICAL ANALYSIS OF WATER AND SOIL

Learning Outcomes (Physico-Chemical Analysis of Soil)-

At the end of the program, the learner should have acquired the listed knowledge and skills like: Collection and preparation of a representative soil sample for analysis, Basics of reagents preparation for soil analysis, follow safety guidelines at the lab, Perform physico-chemical analysis of soil samples, Calculate the amount of nutrients present/required for the soil, Interpretation of results of soil analysis

Sr. No.	Title	Teaching Hrs
1	Determination of pH and EC (Electrical conductivity) in soil sample- Reagents preparation, weighing and analysis of soil sample, calculation of results, interpretation	6
2	Determination of moisture content in soil sample- Reagents preparation, weighing and analysis of soil sample, calculation of results, interpretation	6
3	Determination of organic carbon content in soil sample- Reagents preparation, weighing and analysis of soil sample, calculation of results, interpretation	7.5
4	Determination of available nitrogen content in soil sample- Reagents preparation, weighing and analysis of soil sample, calculation of results, interpretation	6
5	Determination of available phosphorus content in soil sample- Reagents preparation, weighing and analysis of soil sample, calculation of results, interpretation	6
6	Determination of exchangeable potassium content in soil sample- Reagents preparation, weighing and analysis of soil sample, calculation of results, interpretation	6
	Total Hours	37.5

References

- A Text Book of Soil Analysis. by Baruah, T.C. and Barthakur, H.P. (1997) UBS Publishers Ltd., New Delhi.
- Methods of Soil Analysis- Part-1 to 3, Published by American Society of Agronomy- Soil Science Society of America
- Manual on Soil, Plant and Water Analysis, by Dhyani Singh, P. K. Chhonkar and B. S. Dwivedi, Westville Publishing House, New Delhi
- Management of Soil Health: Challenges and Opportunities- by R.K. Thakur S.S. Baghel G.D. Sharma P.C. Amule N. Chouhan, Jawaharlal Nehru Krishi Vishwavidyalaya Jabalpur – 482 004 (M.P.)

Learning Outcomes (Physico-Chemical Analysis of Water)

At the end of the course the student will be able to: Understand the general properties of water, develop awareness about water quality criteria and standards, and their relation to public, health and environment, understand important parameters for measuring water quality, know about the methods for the determination of water quality parameters, learn how to run accurate water quality tests and to determine how the parameters relate to each other, analyze water samples for viable bacterial counts.

Sr.No	Title	Teaching Hours
1	Introduction to analytical laboratory – Safety, Equipment's and techniques used in Laboratory.	5.5
2	To study the physical parameters of water (Temperature, Colour, Odour, Taste, Turbidity, Transparency)	04
3	To determine Alkalinity of Water	03
4	To determine the total hardness of the water sample	03
5	To determine pH and conductance of waste water	03
6	To determine dissolved oxygen of waste water	04
7	To determine Acidity of Water	03
8	To determine TS, TSS, TDS of water	04
9	To determine salinity of the given water sample	03
10	To study the viable count of microorganisms in water sample (N. agar)	05
	Total Hrs.	37.5

References

- APHA (American Public Health Association, American water works Association and water pollution control federation). (1980), Standard methods for the examination of water and waste water, Am. Publication Health Association, Washington, DC, USA.
- NEERI, Manual on water and waste water Analysis, National Environment Engineering Research Institute Nagpur, (3402) (1986).
- WHO, guideline for drinking water quality Genewa (1984)
- Food Safety and Standards Authority of India, Manual of Methods of Analysis of Foods and Water.