GUJARAT VIDYAPITH : AHMEDABAD
Faculty of Science and Applied Science, Sadra, Dist: Gandhinagar
Department of Biogas Research and Microbiology
B.Sc. Semester-I
Core Course :CHEM-101: Physical Chemistry
(Syllabus of theoretical portion) (In force from June, 2018)
(External Evaluation: 60% + Internal Evaluation: 40%)
(Total Teaching Hours=45, Credit=03)

Learning Outcomes:

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

- know about the Ostwald dilution law and its limitations
- understand pH scale and relation between pH and pOH
- explain hydrolysis of salts and derive various relation about hydrolysis of salt
- calculate pH ,$[H^+]$ and $[OH^-]$ of diluted acid-base solutions
- define buffer capacity and buffer limit of buffer solution and understand properties of buffer solutions and action of buffer solutions in adjustment of pH
- calculate the amount of constituents to prepare buffer solutions
- define Molar volume, Surface tension,Parachor,Viscosity,Molar refraction and Optical activity
- understand procedure of determination of surface tension, parachor, viscosity, molar refraction and optical activity
- calculate surface tension, parachor, viscosity, molar refraction and optical activity using given enough data
- define catalyst and catalysis,adsorption, absorption, positive adsorption, negative adsorption, absorbate, desorption
- describe types of catalyst and adsorption
- state the application of adsorption

Note: Each unit must be given equal weightage in examinations

Unit-1: Ionic equilibrium (15 Hours)

1.1 Degree of ionization **(1hour)**

1.2 Ostwald dilution law and its limitations **(1hour)**

1.3 pH scale **(2hours)**

- Definition of pH and importance of pH scale
- Relation between pH and concentration of H^+ in solution
- pH range of acidic, basic solution
- Introduction about pOH, relation between pH and pOH, ionic product of water (K_w)

1.4 Hydrolysis of salts (from weak acid [HA] and strong base [BOH]) including derivation of

- $K_h = \frac{[HA][OH^-]}{[A^-]}$ **(2hours)**
- $K_h = \frac{K_w}{K_a}$
- $h = \sqrt{\frac{K_h}{C}}$

- $pH = \frac{1}{2}[pK_w + pK_a + \log C]$

1.5 Hydrolysis of salts (from weak base [BOH] and strong acid [HA]) including derivation of

- $K_h = \frac{[BOH][H^+]}{[B^+]}$ **(2hours)**
- $K_h = \frac{K_w}{K_b}$
- $h = \sqrt{\frac{K_h}{C}}$
- $pH = \frac{1}{2}[pK_w - pK_b - \log C]$

1.6 Hydrolysis of salts (from weak acid [HA] and weak base [BOH]) including derivation of

- $K_h = \frac{[HA][BOH]}{[A^-][B^+]}$ **(2hours)**
- $K_h = \frac{K_w}{K_a \times K_b}$
- $h = \sqrt{K_h}$
- $pH = \frac{1}{2}[pK_w + pK_a - pK_b]$

1.7 Buffer solutions **(2hours)**

- Properties of buffer solutions
- Buffer capacity and buffer limit of buffer solution
- pH of buffer formed from weak acid and its salt including derivation of Henderson-Hasselbach equation
- pOH of buffer formed from weak base and its salt including derivation of Henderson-Hasselbach equation
- Action of buffer solutions in adjustment of pH during addition of acid or Base
- Buffer standards
- Importance of buffer solutions

1.8 Numericals based on topics 1.3 to 1.7 **(3hours)**

References

1. Chemistry and Chemical Reactivity (fourth edition), John C. Kotz and Paul Treichel,Jr., Saunders college publishing, New York (1999)
2. Fundamental of Analytical Chemistry (seventh edition), Douglas A.Skoog, Donald M.West and F.James Holler, Saunders college publishing, New York (1996)
3. Quantitative Chemical Analysis(sixth edition), Daniel C. Harris, W.H.Freeman(Publisher)

Unit-2: Physical properties and molecular structure (15 Hours)

2.1 Additive and constitutive properties **(1hour)**

2.2 Molar volume: **(2hours)**

- Additivity of molar volume
- Calculation of approximate molar volumes of given compound

2.3 Surface tension: **(2hours)**

-Definition, unit

- Derivation of formula of relative surface tension of liquid
- Use of stalagmometer in determination of relative surface tension of liquid
- Numericals

2.4 Parachor:**(2hours)**
-Relation between parachor, surface tension and molarvolume
-Calculation of approximate parachor of given compound
-Application of parachor
- Numericals

2.5 Viscosity: **(2hours)**
- Definition, unit
-Derivation of formula of relative viscosity of liquid
- Use of Ostwal's viscometer in determination of relative viscosity of given liquid
- Numericals

2.6 Molar refraction: **(2hours)**
- Definition and applications
- Molar refraction of mixture
- Measurement of refraction index by Abbe refractometer
- Numerical

2.7 Optical activity: **(2hours)**
-Definition, measurement by polarimeter
- d / (+) / dextro, l /(-) / levo concept
- Numericals

2.8 Dipole moment, its measurement and its application **(2hours)**

References

1. Text book of Physical Chemistry (second edition), Samuel Glasstone, Macmillan India Ltd., pp.524-556 (1991)
2. Encyclopedia of Industrial Chemical Analysis (volume-3), Foster Dee Snell and Clifford L. Hilton, Inter science publishers(John Wiley and Sons,Inc.,New York), pp. 584-598, 768-774 (1966)
3. Catalysis:Principles and Applications, B.Vishwanathan, S.Sivasanker, A.V. Ramaswamy, Narosa Publishing House(2002).

Unit-3: (A) Catalysis (8 Hours)

3(A).1 Definition of catalyst and catalysis**(1 hour)**
3(A).2 Types of catalyst: positive catalyst, negative catalyst and auto catalyst**(1 hour)**
3(A).3 Catalytic reaction: homogeneous catalytic reaction and Heterogeneous catalytic reaction**(1 hour)**
3(A).4 Characteristics of catalyst**(1 hour)**
3(A).5 Action of finely divided catalyst**(1 hour)**
3(A).6 Catalytic promoters or activators**(1 hour)**
3(A).7 Catalytic poisons or anticatalysts**(1 hour)**
3(A).8 Enzyme catalyst: definition and characteristics**(1 hour)**

Unit-3: (B) Adsorption (7 Hours)

3(B).1 Definition of adsorption, absorption, positive adsorption, negative adsorption, absorbate, desorption**(1 hour)**
3(B).2 Types of adsorption (physical adsorption, chemical adsorption)**(2 hours)**
3(B).3 Adsorption of gases by solids**(1 hour)**

3(B).4 Freudlich and langmuir adsoption isotherm(derivation)**(2 hours)**
3(B).5 Application of adsorption**(1 hour)**

References

1.Catalysis:Principles and Applications, B.Vishwanathan, S.Sivasanker, A.V. Ramaswamy, Narosa Publishing House(2002).
2. Essential of Physical Chemistry ., B.S.Bahl, G.D. Tuli and Arun Bahl , S.Chand New Delhi(2006)

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Board of Studies(Chemistry)

(1) Prof.(Dr.) Nikhil S. Bhatt

(2) Dr. Dasharath P. Patel

(3) Dr. Yogesh S. Patel

(4) Dr. Hitesh J. Shah

(5) Dr. Ketul N.Patel

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

GUJARAT VIDYAPITH : AHMEDABAD
Faculty of Science and Applied Science, Sadra, Dist: Gandhinagar
Department of Biogas Research and Microbiology
B.Sc. Semester-I
Core Course:CHEM-101: Physical Chemistry
(Syllabus of practical portion) (In force from June, 2018)
(External Evaluation: 60% + Internal Evaluation: 40%)
(Total Teaching Hours=45, Credit=1.5)

Learning Outcomes:

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

- prepare percentage solution
- prepare and standardize acid(mono and di basic)-base (mono and di acidic)solution
- determine density, surface tension,viscosity, refractive index of organic liquids

(A) Solution preparation (21 Hours)

(1) General introduction ,Percentage solution: %v/v, %w/v**(3hours)**

(2)Preparation and standardization of sodium hydroxide solution(approximately 0.1 N) **(3 hours)**

(3)To determine normality of given HCl/HNO_3 solution using standard sodium hydroxide Solution**(3 hours)**

(4) Preparation and standardization of hydrochloric acid solution (approximately 0.1 N) **(3hours)**

(5) To determine normality of given NaOH/KOH solution using standard hydrochloric acid solution**(3 hours)**

(6) Preparation of molar and normal solution of H_2SO_4 **(3 hours)**

(7)Preparation of molar and normal solution of Na_2CO_3**(3 hours)**

(B) Experiments of Physical chemistry (24 Hours)

(1) To measure the density of a given liquid by R.D. bottle**(3hours)**

(2) To determine the relative surface tension of a liquid with respect to water at room temperature by Stalagmometer**(3hours)**

(3) To determine the surface tension of methyl alcohol, ethylalcohol and n-hexane at room temperature and calculate the atomic parachors of carbon, hydrogen and oxygen**(6hours)**

(4) To determine the relative viscosity of a liquid with respect to water at room temperature by Ostwald's viscometer**(6 hours)**

(5) To determine the composition of a given mixture consisting of two miscible liquids, A and B by viscosity measurement**(3 hours)**

(6) To determine the refractive index of a given liquid and find its specific and molar refractivities**(3 hours)**

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GUJARAT VIDYAPITH, AMADAVAD

MAHADEV DESAI GRAM SEVA MAHAVIDYALAYA, SADRA,

DEPARTMENT OF MICROBIOLOGY

SEMESTER 1

PHY-101 PHYSICS I

(Syllabus of theoretical portion) (In Force from June 2018)

Total marks: 100

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

Total teaching hours: 45 hours, Credit =03)

Learning outcomes

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

- Get information about the mathematical methods of physics
- Have gained basic knowledge of laser and working of different type of lasers
- Understand the basics of modern optics like Fiber optics
- Have a basic knowledge of semiconductor physics
- Acquire knowledge about how a semiconductor diode rectifies an input ac signal
- To understand basic logic gates and universal gates and their truth tables
- To understand the applications of the laws of thermodynamics
- Become familiar with various thermodynamic process and work done in each of these processes.
- Have a clear understanding about Reversible and irreversible process and also working of a Carnot engine, and knowledge of calculating change in entropy for various process.

UNIT 1 VECTORS 11hrs

- Introduction: Scalars and vectors, Addition of vectors, Subtraction of vectors, Scalar (Dot) product, Vector(Cross) product, Unit vector, Position vector
- Triple Scalar Product & its applications
- Triple Vector Product & its applications
- Classification of vectors:

  Pseudo vector, Polar vector, Pseudo scalar, Real scalar,

Free vector, Bound vector

References:
- ❖ Introduction to classical Mechanics By R. G. Takwale& P. S. Puranik, Tata McGraw-Hill Publishing company Ltd, New Delhi
- ❖ Mathematical methods in Physical Sciences by M. L. Boas, John Wiley & Sons
- ❖ Engineering Physics By R. K. Gaur and S. L. Gupta

UNIT 2 **(A) LASER** **06hrs**

- Introduction: Absorption, Spontaneous and Stimulated (Induced) Emission of Radiation
- Basic principle and operation of a laser
- Population Inversion
- Pumping and active system
- Ruby laser- its construction and working
- Gas laser (He-Ne laser- its construction and working)
- Applications/Uses of Laser

References:
- ❖ Engineering Physics By R. K. Gaur and S. L. Gupta
- ❖ An introduction to LASERS- Theory and applications By M. N. Avadhanulu, S chand and Comp Ltd.

(B) FIBER OPTICS **05hrs**

- Principle of optical fiber
- Structure of optical fiber
- The numerical aperture
- Applications of fiber optics

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

UNIT 3 **D.C. CIRCUITS AND ELECTRONICS** **12hrs**

D. C. Circuits:

- R-C D. C. circuit (charging and discharging of capacitor)
- R-L D.C. circuits (growth and decay of current)

Diode circuits:

- The p-n junction
- The unbiased diode
- Forward and Reverse biased diodes – its characteristics

- Half wave rectifier
- Full wave rectifier
- Bridge rectifier
- Zener effect and Avalanche effect
- Zener diode & its characteristics
- Logic Gate(AND, OR,NOT,NAND and NOR)

References:

- ❖ Modern electronics instrumentation and measurement techniques by Helfrick and Cooper, PHI
- ❖ Engineering Physics By R. K. Gaur and S. L. Gupta
- ❖ Electronic devices and circuits By Allen Mottershead

UNIT 4 THERMODYNAMICS 11hrs

- Introduction: Thermodynamic laws (only definition)
- Carnot Theorem
- Principle & working of Refrigerator, Phase diagram, triple point, Kelvin temperature scale
- Clausius- Clapeyron's Equation
- Concept of entropy
- General expression of change of entropy of a perfect gas

References:

- ❖ Engineering Physics By R. K. Gaur and S. L. Gupta
- ❖ Heat & Thermodynamics By Zeemansky

GUJARAT VIDYAPITH, AMADAVAD

MAHADEV DESAI GRAM SEVA MAHAVIDYALAYA, SADRA,

DEPARTMENT OF MICROBIOLOGY

SEMESTER 1

PHY-101 PHYSICS I

(Syllabus of Practical portion) (In Force from June 2018)

Total marks: 100

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

Total practical hours: 45hr, Credit =1½)

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1. To use a multimeter for measuring (a) resistance, (b) AC & DC voltages (c) DC current (d) capacitance (e) temperature
2. To determine the value of capacitors.
3. To study the decay of capacitor.
4. To determine the value of inductor.
5. To study half wave rectifier with and without filter.
6. To study full wave rectifier with and without filter.
7. To study bridge rectifier with and without filter.
8. To study the characteristics of Zener diode.
9. To study various logic gates.
10. To determine the wavelength of LASER light.
11. Thermocouple
12. Thermistor
13. RTD

GUJARAT VIDYAPITH, AMADAVAD

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DEPARTMENT OF MICROBIOLOGY

SEMESTER 2

PHY-201 PHYSICS II

(Syllabus of theoretical portion) (In Force from June 2018)

Total marks: 100

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

Total teaching hours: 45hr, Credit =03)

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 understand production of X-ray and its applications. Also get the information about X-ray diffraction techniques and its applications
- Learn the fundamentals of harmonic oscillator model, including damped and forced oscillators.

UNIT 1 OPTICS 12hrs

Interference

- Principle of super position
- Interference of light
- Types of interferences

DIFFRACTION

- Diffraction
- Types of diffraction
- Difference between diffraction and interferences
- Zone plate

RESOLVING POWER OF OPTICAL INSTRUMENTS

- Resolution, Resolving power and Rayleigh's criterion
- Resolving power of Prism
- Plane diffraction grating- Resolving power of Plane 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 AjoyGhatak (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, (Addision 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 **X-RAYS** **11hrs**

- Discovery of X-rays
- Production of X-rays
- Origin of X-rays
- Properties of X-rays
- Diffraction of X-rays
- Bragg's law& crystal structure

- Crystallography by powder diffraction method
- Crystal rotating method
- Applications of X-rays

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

UNIT 4 OSCILLATION **11hrs**

- Equation of displacement, velocity & acceleration
- Combination of two S.H.M. having same time period but different phase (Algebraic method &Graphical method)
- Particular case of Phase differences
- Lissajous figures, their demonstration using CRO
- Uses of Lissajous figures
- Combination of more than two S.H.M (Graphical method)

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

GUJARAT VIDYAPITH, AMADAVAD

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DEPARTMENT OF MICROBIOLOGY

SEMESTER 2

PHY-201 PHYSICS II

(Syllabus of Practical portion) (In Force from June 2018)

Total marks: 100

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

Total practical hours: 45hr, Credit =1½)

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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 verify the Stefan Boltzman's fourth power law using AC source.
6. To study the error and analyze the given data having errors and propagated also to find the percentage errors of the given problems.
7. To study nuclear radioactive decay using simulation.
8. Determination of Miller Indices
9. Simple Pendulum
10. To find out absorption coefficient of liquid with the help of photovoltaic cell.

GUJARAT VIDYAPITH, AMADAVAD

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DEPARTMENT OF MICROBIOLOGY

SEMESTER 1

EC-103: PHYSICS

(Syllabus of theoretical portion) (In Force from June 2018)

Total marks: 100

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

Total teaching hours: 30 hr, Credit =02)

Learning outcomes

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

- To learn about sensors and its various characterizations
- To understand basic concept and history of biosensor
- Familiarize with various biological elements and its uses
- To understand different electrodes and its application
- To get the information about how to design or make such electrodes and biosensors.

UNIT 1 SENSORS AND ITS CHARACTERIZATIONS 07 hrs

What are Sensors / Transducers? Importance of Sensors , Principles of sensor, static characteristics, dynamic characteristics, Characterizations- electrical, mechanical, high temperature etc.

(i) **Thermal Sensor:** Thermocouple, thermistor, RTD,

(ii) **Optical Sensor:** Photo resistor, photo diode, photo voltaic cell, photo multiplier tube.

(iii) **Vacuum gauge:** Pirani gauge, Penning gauge &Mcleode gauge

UNIT 2 BIOSENSORS **08 hrs**

Introduction, applications of biosensor, generation of biosensors, glucose biosensor, urea biosensor.

Biological Sensing Elements

Introduction, Enzymes, Examples of Enzyme Biosensors, Tissue Materials, Microorganism, Mitochondria, antibodies, Nucleic Acid, Receptors.

UNIT 3 IMMOBILIZATION TECHNIQUES OF BIOLOGICAL COMPONENT AND ITS APPLICATION **07 hrs**

Adsorption, Micrencapsulation, Entrapment, Cross linking, Covalent Bonding, Modified electrodes, Examples of applications of different immobilization methods.

UNIT 4 SENSOR OPERATING PRINCIPLES **08 hrs**

Reference electrode, Calomel Electrode, practical aspects of ion selective electrodes, Measurements and calibration, examples of ion electrode: Glass Electrode, solid state type, liquid ion exchange membrane type, glass sensing electrode, Combined Electrode, solid state electrode, screen printed electrode, amperometric sensors, voltametric sensors.

Reference Books

1. Sensors and TransducersD.Patranabis, Prentice hall of India
2. Heat and Thermodynamics, Mark W. Zemansky and Richard Dittman
3. Biosensors: An Introduction, Brain Eggins, Wiley Teuinee
4. Advances in Biosensors, Editor Anthony P.F. Turner, Supplement 1: 1993 Chemical Sensors for In Vivo Monitoring, Jai Press Ltd. Greenwich, Connecticut
5. Biosensors, Tran Minh Canh, Chapman and Hall

GUJARAT VIDYAPITH: AHMEDABAD
Faculty of Science and Applied Science, Sadra, Dist. Gandhinagar
Department of Biogas Research and Microbiology
Semester 1: ENG 101: English
Learning Objectives and Syllabus
(External Evaluation: 60% + Internal Evaluation: 40%)
(Total Teaching Hours: 23, Credit: 1.5)

Learning Objectives:

1. To read simple passages to find out information contained it.
2. To familiarize students with vocabulary used in the passages.
3. To familiarize students with the functions of tenses generally used in daily life.
4. To help students in writing short descriptive paragraphs based on pictures.
5. To develop among students the academic skill of referencing.

Unit 1: Comprehension and Vocabulary (50%; 12 Hours)

1. The Kite Maker by Ruskin Bond
2. The Portrait of a Lady by Khushwant Singh
3. Print Advertisement –Admission Announcement
4. Print Advertisement –Sales Advertisement

Exercises:

1. Short questions
2. Fill in the blanks
3. Multiple choice questions based on the text
4. Antonyms/Synonyms
5. Match words with their meanings

NB: Short questions as well as other exercises should be informative in nature.

Unit 2: Grammar (30%: 6 Hours)

1. Noun: Number and Gender
2. Articles
3. Simple Present Tense
4. Present Continuous Tense
5. Simple Past Tense
6. Past Continuous Tense
7. Subject-Verb Agreement***NB: Unit 2should be done along with Unit 1 so that students can see how these grammatical***

categories actually work to produce meaning.

Unit 3: Writing Skills (20%; 3 Hours)

1. Picture Reading (Use of Simple Present Tense and Present Continuous Tense)

NB:Use at least five pictures in the classroom for demonstration as well as practice.

Unit 4: Academic Skills: Reference Skills (2 Hours)

1. Types of dictionaries
2. Functions of a dictionary
3. How to use a dictionary?
4. Optimum utilization of dictionary
5. Dictionary and pronunciation
6. How to use a thesaurus?
7. Online dictionaries and thesaurus
8. Inbuilt dictionaries in Word Processors
9. Mobile dictionaries
10. Guessing meaning from the context.

NB: This unit is not to be asked in the examination.

List of Reference Books:

Tickoo, M. L. *et al.* Eds. *I Am The People: English Reader*. Delhi: CBSE, 1996.

Achar, Deeptha *et al.*Eds. *English for Academic Purposes Book –1*.Gandhinagar: University
Granthnirman Board, 2011.
Achar, Deeptha *et al.*Eds. *English for Academic Purposes Book –2*.Gandhinagar: University
Granthnirman Board, 2011.**GU**

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

(Syllabus of theoretical portion) (In force from June, 2018)
(External Evaluation: 60% + Internal Evaluation: 40%)
(Total Teaching Hours=45, Credit=03)

LEARNING OUTCOMES:

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

- Get Knowledge regarding Prokaryotes, Taxonomy process and different systems of classification of bacteria
- Understand Cellular organization 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
- Aware about how bacterial growth can be controlled by various Physical and Chemical agents

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UNIT 1. Typical Prokaryotes: Taxonomy and cellular organization (11Hours)

A) Taxonomy: (6Hours)

1. Principles of binomial system of nomenclature
2. Introduction to different systems of bacterial classification

B) Cellular organization: (5Hours)

1. Size, shape and arrangement of bacteria
2. Bacterial endospore: Spore structure, Sporulation and Spore germination

UNIT 2. Structure of typical bacterial cell (11Hours)

A) Surface appendages: (4Hours)

1. flagella
2. pili and fimbriae
3. Prosthecae and stalks

B) Surface layers: (3Hours)

1. Capsule and slime layer
2. Cell wall
3. Cytoplasmic membrane and mesosomes

C) Cytoplasm and cell organelles: (4 Hours)

1. Cytoplasm
2. Ribosome
3. Nuclear material and Plasmid
4. Cellular reserve food material

UNIT 3. Introduction to Bacterial nutrition (11Hours)

A) Nutritional diversities in bacteria **(3 Hours)**

B) Nutritional requirements of bacteria **(3 Hours)**

C) Culture media: **(3 Hours)**

1. Principles of media formulation
2. Media ingredients
3. Types of media

D) Cultivation methods of bacteria. Growth characteristics in broth and solid media

(2 Hours)

UNIT 4. Principles of Microbial control (12Hours)

A) General principles: Control by killing, inhibition and removal (2 Hours)

B) Physical agents of microbial control: (4 Hours)

1. Heat
2. Radiation
3. Osmotic pressure
4. Filtration

C) Chemical agents of microbial control: (5 Hours)

Ideal antimicrobial agent. Major groups of antimicrobial agents:

1. Phenols
2. Halogens
3. Surfactants
4. Alcohols
5. Heavy metals
6. Gaseous agents

Text book: Pelczar Jr, M J, Chan ECS, Krieg N R, (1986), Microbiology: An Application

Based Approach, 5th edn. McGraw-Hill Book Company, NY

Suggested readings:

• Ingraham J L and Ingraham C A Introduction to Microbiology: Thomson Brooks/Cole

• Atlas R M, (2015), Principles of Microbiology 2"" Edition, McGraw Hill education,

Mumbai

Board of Studies (Microbiology)

(1) Dr. Nikhil S. Bhatt
(2) Dr. S. R. Dave
(3) Dr. Devyani Tipre
(4) Dr. Rakesh Patel
(5) Dr. Nupur Goyal
(6) Dr. Srinivas Duggirala
(7) Dr. Niraj Sheth
(8) Mrs. Priti Shukla
(9) Mr. Arvind Dungrechiya

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

(Syllabus of Practical portion) (In force from June, 2018)
(External Evaluation: 60% + Internal Evaluation: 40%)
(Total Teaching Hours=45, Credit=1.5)

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
- Will know effect of various physical agents on growth of bacteria

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1. Cultivation methods for bacteria

a. Broth culture

b. Agar slope/slant culture

c. Agar plate method

i. Streak plate method

ii. Pour plate method

iii. Spread plate method

2. Cultivation of anaerobic bacteria by use of

a. Robertson's cooked meat media

b. Thioglycollate broth

c. Anaerobic j ar (Demonstration)

3. Preservation of microbial cultures

a. Periodic sub culturing and storage at refrigeration temperature

b. Preservation in soil Azotobacter)

4. Study of pigmented bacteria

a. *Staphylococcus aureus*

b. *Staphylococcus epidermidis*

c. *Micrococcus luteus*

d. *Serratia marscescens*

e. *Pseudomonas aeruginosa*

5, 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

6, Use of special staining technique to study bacteria

a. Spirocheates by Fontana's method

7. 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)

Board of Studies (Microbiology)

(1) Dr. Nikhil S. Bhatt

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(5) Dr. Nupur Goyal

(6) Dr. Srinivas Duggirala

(7) Dr. Niraj Sheth

(8) Mrs. Priti Shukla

(9) Mr. Arvind Dungrechiya

MIC -201 Basic Bacteriology

Scheme for Practical Examination
Marks

Ex 1 Staining of Bacteria: Structural and special staining	**(15)**
Ex 2 Study of effect of physical agent on growth of bacteria/Isolation And cultivation of bacteria	**(20)**
Ex 3 Spotting	**(10)**
Ex 4 Viva voce	**(10)**
Ex 5 Journal and slides	**(05)**

GUJARAT VIDYAPITH : AHMEDABAD
Faculty of Science and Applied Science, Sadra, Dist: Gandhinagar
Department of Biogas Research and Microbiology
B.Sc. Semester-II
Core Course: CHEM-201: Inorganic Chemistry
(Syllabus of theoretical portion) (In force from December, 2018)
(External Evaluation: 60% + Internal Evaluation: 40%)
(Total Teaching Hours=45, Credit=03)

Learning Outcomes:
After studying this paper student will be able to.....
*distinguish double salts and coordination compounds
* describe Werner's work
*state the types of ligands
*understand isomerism,stability and applications of coordination compounds
*understand Sidgwick-Powell theory and Valence Shell Electron Pair Repulsion (VSEPR) theory
*apply understanding of VSEPR theory for deciding the shape and bond angle of various molecules
*differentiate Sigma and pi bonds
*explain molecular orbital treatment for homo and hetero nuclear diatomic molecules
*write electronic configuration of elements of lanthanide series and actinide series
*know oxidation states,Magnetic properties,colour and absorption spectra of lanthanide and actinide ions
*describe the Lanthanide contraction and Actinide contraction

Note: Each unit must be given equal weightage in examinations

Unit-1: Coordination Compounds **(15 Hours)**

1.1 Double salts and Coordination compounds **(2 hours)**
1.2 Werner's work **(2 hours)**
1.3 Types of ligands **(1.5 hours)**
1.4 Chelate compound **(0.5 hour)**
1.5 Isomerism of coordination compounds **(3 hours)**
-Geometrical isomerism
-Optical isomerism
-Ionization isomerism
-Linkage isomerism
-Coordination isomerism
1.6 Stability of coordination compounds **(2 hours)**
-Stepwise and overall formation constants
1.7 Bonding in coordination compounds **(2 hours)**
-Crystal Field Theory
1.8 Applications of coordination compounds **(2 hours)**

References

1. Basic Inorganic Chemistry (Third edition), F.Albert cotton, Geoffrey Wilkinson and Paul L.Gaus., John Wiley and Sons,Inc.,New York., pp.165-185 (1995) .
2. Concise Inorganic Chemistry (Fifth edition), J.D.Lee., Blackwell Science Ltd.,Oxford., pp.194-236(1996) .

Unit-2: Covalent Bonding and Molecular Orbitals (15 Hours)

2.1 Introduction **(1 hour)**
2.2 Sidgwick-Powell theory **(1 hour)**
2.3 Valence Shell Electron Pair Repulsion (VSEPR) theory **(1 hour)**
2.4 Some examples using the VSEPR theory **(2 hours)**
-$BeCl_2$
- BF_3
-NH_3
-H_2O
-PCl_5
-SF_6
-IF_7
2.5 Sigma and pi bonds **(0.5 hour)**
2.6 Molecular orbital method **(0.5 hour)**
2.7 Linear Combination of Atomic Orbitals (LCAO) method **(2 hours)**
-s-s combinations of orbitals
-s-p combinations of orbitals
-p-p combinations of orbitals
-p-d combinations of orbitals
-d-d combinations of orbitals
- Nonbonding combinations of orbitals
2.8 Rules for Linear Combination of Atomic Orbitals**(1 hour)**
2.9 Examples of molecular orbital treatment for homonuclear diatomic molecules **(4 hours)**
-H_2^+ molecule ion
-H_2 molecule
-He_2^+ molecule ion
-He_2 molecule
-Li_2 molecule
-Be_2 molecule
-B_2 molecule
-C_2 molecule
-N_2 molecule
-O_2 molecule
-O_2^- molecule ion
-O_2^{2-} molecule ion
-F_2 molecule
2.10 Examples of molecular orbital treatment for heteronuclear diatomic molecules **(2 hours)**
-NO molecule
-CO molecule
- HCl molecule

Unit-3(A): The lanthanide series **(6 Hours)**

3(A).1 Electronic configuration**(1 hour)**
3(A).2 Oxidation states**(1hour)**
3(A).3 Magnetic properties**(1 hour)**
3(A).4 Colour and absorption spectra of lanthanide ions**(1 hour)**
3(A).5 Lanthanide contraction**(1 hour)**
3(A).6 Separation and purification of lanthanides :Ion exchange and solvent extraction methods**(1 hour)**

Unit-3(B): The Actinide series **(9 Hours)**

3(B).1 Electronic configuration**(1 hour)**
3(B).2 Oxidation states **(1 hour)**
3(B).3 Magnetic properties **(1 hour)**
3(B).4 Colour and absorption spectra of actinide ions **(1 hour)**
3(B).5 Actinide contraction **(1 hour)**
3(B).6 Nuclear synthesis of trans uranic elements **(1 hour)**
3(B).7 Chain reaction **(1 hour)**
3(B).8 Importance of uranium **(1 hour)**
3(B).9 Comparison with lanthanides **(1 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) .

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Board of Studies(Chemistry)

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

GUJARAT VIDYAPITH : AHMEDABAD
Faculty of Science and Applied Science, Sadra, Dist: Gandhinagar
Department of Biogas Research and Microbiology
B.Sc. Semester-II
Core Course: CHEM-201: Inorganic Chemistry
(Syllabus of practical portion) (In force from December, 2018)
(External Evaluation: 60% + Internal Evaluation: 40%)
(Total Teaching Hours=45, Credit=1.5)

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 (45 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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Board of Studies(Chemistry)

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GUJARAT VIDYAPITH: AHMEDABAD
Faculty of Science and Applied Science, Sadra, Dist: Gandhinagar
Department of Biogas Research and Microbiology
B.Sc. Semester-II
Generic Elective GE - Green Chemistry
(Syllabus of theoretical portion) (In force from June, 2018)
(External Evaluation: 60% + Internal Evaluation: 40%)
Total Teaching Hours=30, Creadit=2)

Learning Outcomes:
After studying this paper student will be able to..…
• understand to green chemistry as a need of society
• describe the twelve principles of green chemistry
• state the future trends in Green Chemistry

Note: Each Unit must be given equal weightage in Examination

Unit 1) Introduction **(15 Hours)**

1.1. Current status of chemistry and the Environment.

1.2. Evolution of the Environmental movement

- ✓ Public awareness
- ✓ Dilution is the solution to pollution
- ✓ Waste treatment and abatement through command and control .
- ✓ Pollution prevention
- ✓ The role of Chemistry

1.3. Green Chemistry

- ✓ What is Green Chemistry
- ✓ Definition
- ✓ Why is this new area of Chemistry getting to much attention
- ✓ Why should chemist pursue the Goals of Green Chemistry
- ✓ The roots of innovation
- ✓ Limitations / obstacles

Unit 2) Tools of Green Chemistry **(15 Hours)**

1.1. Principles of Green Chemistry

- ✓ Alternative feed stocks starting material
- ✓ Alternative Reagents
- ✓ Alternative Solvents
- ✓ Alternative products /Target molecules
- ✓ Process Analytical Chemistry
- ✓ Alternative Catalysts

1.2. Future trends in Green Chemistry

- ✓ Green analytical methods
- ✓ Redox reagents
- ✓ Green Catalysts
- ✓ Green nano-synthesis
- ✓ Green polymer chemistry
- ✓ Exploring nature
- ✓ Biomimetic
- ✓ Proliferation of solvent-less reactions
- ✓ Non-covalent derivatization
- ✓ Biomass conversion
- ✓ emission control

References

1. V. Kumar, “An Introduction to Green Chemistry” Vishal publishing Co. Reprint Edition 2010
2. Rashmi Sanghi, M.M Srivastava “Green Chemistry” Fourth Reprint - 2009
3. Anastas & Warner, Green Chemistry: Theory & Practice ,Oxford Univ. Press,New York,1998

Board of Studies(Chemistry)

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GUJARAT VIDYAPITH, AMADAVAD
MAHADEV DESAI GRAM SEVA MAHAVIDYALAYA, SADRA,
DEPARTMENT OF MICROBIOLOGY
SEMESTER 2
PHY-201 PHYSICS II
(Syllabus of theoretical portion) (In Force from June 2018)
Total marks: 100
(Internal evaluation: 40 Marks + External evaluation: 60 Marks)
Total teaching hours: 45hr, Credit =03)

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 understand production of X-ray and its applications. Also get the information about X-ray diffraction techniques and its applications

Learn the fundamentals of harmonic oscillator model, including damped and forced oscillators

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UNIT 1 OPTICS

Interference **12hrs**

• Principle of super position
• Interference of light
• Types of interferences

DIFFRACTION

• Diffraction
• Types of diffraction
• Difference between diffraction and interferences
• Zone plateRESOLVING POWER OF OPTICAL INSTRUMENTS
• Resolution, Resolving power and Rayleigh's criterion
• Resolving power of Prism
• Plane diffraction grating- Resolving power of Plane 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 AjoyGhatak (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, (Addision 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 X-RAYS **11hrs**

• Discovery of X-rays
• Production of X-rays
• Origin of X-rays
• Properties of X-rays
• Diffraction of X-rays
• Bragg's law& crystal structure • Crystallography by powder diffraction method
• Crystal rotating method
• Applications of X-rays

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

UNIT 4 OSCILLATION **11hrs**

• Equation of displacement, velocity & acceleration
• Combination of two S.H.M. having same time period but different phase (Algebraic method &Graphical method)
• Particular case of Phase differences
• Lissajous figures, their demonstration using CRO
• Uses of Lissajous figures
• Combination of more than two S.H.M (Graphical method)

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

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DEPARTMENT OF MICROBIOLOGY
SEMESTER 2
PHY-201 PHYSICS II
(Syllabus of Practical portion) (In Force from June 2018)
Total marks: 100
(Internal evaluation: 40 Marks + External evaluation: 60 Marks)
Total practical hours: 45hr, Credit =1½)

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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 verify the Stefan Boltzman's fourth power law using AC source.
6. To study the error and analyze the given data having errors and propagated also to find the percentage errors of the given problems.
7. To study nuclear radioactive decay using simulation.
8. Determination of Miller Indices
9. Simple Pendulum
10. To find out absorption coefficient of liquid with the help of photovoltaic cell.

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Faculty of Science and Applied Sciences, Sadra, Dist: Gandhinagar
Department of Biogas Research and Microbiology
B.Sc. Semester-II
Generic Elective Course :GE-202 : Biogas Technology
(Syllabus of theoretical portion) (In force from December, 2018)
(External Evaluation: 60% + Internal Evaluation: 40%)
(Total Teaching Hours=30, Credit=02)

Learning Outcomes:

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

- know history of biogas technology
- understand biochemistry of biogas production
- state the different raw materials for biogas production
- explain factor affecting the production of biogas
- describe the qualitative and quantitative analysis of biogas
- know the types of biogas plants
- understand the operating and maintaining system
- know importance of biogas and digested slurry
- calculate economics of biogas plant

Note: Each unit must be given equal weightage in examinations

Unit-1: Biogas **(15 Hours)**

1.1 Introduction: Definition, History of biogas**(2hours)**
1.2 How biogas is produced? (Biochemistry) **(3hours)**
1.3 Use of different raw materials for biogas production **(3hours)**
1.4 Factor affecting the production of biogas**(4hours)**
1.5 Qualitative (by Orset apparatus) and quantitative(by flow meter) analysis of biogas production**(3hours)**

Unit-2: Biogas Plant **(15 Hours)**

2.1Types of biogas plant models (Design) **(3hours)**
2.2 How operate the biogas plants? **(1hours)**
2.3 Maintenance of biogas plants **(4hours)**
2.4 Uses of biogas **(2hours)**
-Lightning
-Cooking
-Vehicle fuel
-Electricity generation
2.5 Utilization of digested slurry **(3hours)**
2.6 Economics of biogas plant **(2hours)**

References

1. Biogas Systems:Principle and Applications, K.M.Mital,New Age International(P) Limited, New Delhi,(1996)

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Science and Applied Science, Sadra, Dist. Gandhinagar
Department of Biogas Research and Microbiology
Semester 2: ENG 201: English
Learning Objectives and Syllabus
(External Evaluation: 60% + Internal Evaluation: 40%)
(Total Teaching Hours: 23, Credit: 1.5)

Learning Objectives:

1. To read different kinds of simple material to find out information contained it.
2. To familiarize students with vocabulary used in the passages.
3. To acquaint students with vocabulary having multiple meanings.
4. To familiarize students with the functions of some of the tenses.
5. To orient students towards electronic communication.
6. To develop among students the academic skills of locating books and journals.

Unit 1: Comprehension and Vocabulary (50%; 10Hours)

1. To Sir, with Love by E. R. Braithwaite
2. My Struggle for an Education by Booker T. Washington
3. Sample of Invitation Cards
4. Sample of Notices

Comprehension Pattern:

1. Short questions
2. Fill in the blanks
3. Multiple choice questions based on the text
4. Antonyms/Synonyms (Based on the comprehension texts only)
5. Homophones and Homonyms

NB: Short questions as well as short notes should be informative in nature.

Unit 2: Grammar (20%; 5 Hours)

1. Pronouns (Detailed Study)
2. Present Perfect Tense
3. Present Perfect Continuous Tense
4. Past Perfect Tense
6. Past Perfect Continuous Tense**Unit 3: Writing Skills (30%; 06Hours)**
1. Writing Emails
2. Describing an Experiment

NB: Only those experiments are to be considered which students undertake in their laboratory.

Unit 4: Academic Skills: Reference Skills (02Hours)

1. Accessing Books and Journals in a Library
2. Using Index of a book to locate specific information

NB: This unit is not to be asked in the examination.

List of Reference Books:

Achar, Deeptha et al. Eds. *English for Academic Purposes Book –1*. Gandhinagar: UniversityGranthnirman Board, 2011.
Achar, Deeptha et al. Eds. *English for Academic Purposes Book –1*. Hyderabad: OrientBlackSwan,
2012.
Achar, Deeptha et al. Eds. *English for Academic Purposes Book –2*. Gandhinagar: UniversityGranthnirman Board, 2011.
Achar, Deeptha et al. Eds. *English for Academic Purposes Book –2*. Hyderabad: OrientBlackSwan,
2013.
Tickoo, M. L. et al. Eds. *I Am The People: English Reader*. Delhi: CBSE, 1996.

Wren, P. C. and H. Martin. *High School English Grammar and Composition*. (Gujarati). Trans.Dr.
Usha Upadhyay and Jegeesha Upadhyay. New Delhi: S. Chand, 2013

GUJARAT VIDYAPITH : AHMEDABAD
Faculty of Science and Applied Science, Sadra, Dist: Gandhinagar
Department of Biogas Research and Microbiology
B. Sc. Semester-III

MIC-301 Microbial Physiology

(Syllabus of theoretical portion) (In force from June, 2019)
(External Evaluation: 60% + Internal Evaluation: 40%)
(Total Teaching Hours=45, Credit=03)

LEARNING OUTCOMES:

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

- Understand the concept of Nutrition of the Bacteria and develop an understanding of growth and various parameters affecting to the growth also get the information about how bacterial cell uptake nutrition from the media , Students will understand Classification of bacteria on the basis of different parameters
- Students will Gain knowledge about the properties of enzymes and how it works& what is the structure of enzyme ,Role of enzymes in Microbial cell also students can learn about what factors will affect the optimum activity of enzymes and how enzymes can inhibited their over acting activity
- Also by this paper learning students will aware profoundly about how bacteria and other Microbial cell can reproduced ,how new cell formation process will occur,what is growth ,how growth can be measured, how was the life cycle of bacteria, what are different types of growth
- Basic understanding of bio-molecules and their role in metabolism

UNIT 1. Microbial Nutrition and Factors Affecting (11 Hours)

1. Culture media: Types of culture media: Routine and specialized media; Selective media, differential media, enriched media, enrichment media, enumeration media, assay media and maintenance media **(4 Hours)**

2. Modes of nutritional uptake **(4 Hours)**

   a. Entry of nutrition in the cell, passive diffusion, facilitated diffusion and active transport,
   b. Utilization of nutrients that cannot enter the cell

3. Classification of bacteria on the basis of growth supporting environmental factors such as oxygen, temperature, pH, osmotic pressure, salt and hydro static pressure. **(3 Hours)**

UNIT 2. Enzymes (11 Hours)

1. General introduction **(5 Hours)**

   a. Physical and chemical properties
   b. Structure of enzymes: Prosthetic group, apoenzyme, coenzymes, cofactors

c. Localization of enzymes: Extra cellular and intra cellular
d. Nomenclature and classification of enzymes, lUB system of enzyme classification

2. Enzyme action **(6 Hours)**

a. Active sites of enzymes
b. Mechanism of enzyme action
c. Factors affecting enzyme activity
d. Inhibition of enzyme activity: Competitive and non-competitive

UNIT 3. Microbial growth **(12 Hours)**

1. Methods of reproduction in bacteria and new cell formation **(2 Hours)**

2. Growth **(5 Hours)**

a. Introduction to growth rate, generation time
b. Criteria for growth measurement: Cell mass and cell number, methods of
c. their measurement
d. Normal growth curve of bacteria
e. Continuous growth and synchronous growth

3. Chemotherapeutic agents as growth inhibitors **(5 Hours)**

a. Principles of chemotherapy
b. General mode of action of various chemotherapeutic agents: Sulfonamides, antibiotics (penicillin, streptomycin, Polymixin)

UNIT 4. Biomolecules and metabolism **(11 Hours)**

1. Biomolecules: Chemical structure, properties, classification and biological significance of carbohydrates, proteins, lipids and nucleic acids **(6 Hours)**

2. Introduction to metabolism **(5 Hours)**

a. Anabolism, catabolism, primary and secondary metabolism
b. Role of reducing power, precursor metabolites and energy rich compounds in cell
Metabolism

Text Books:

1. Pelczar Jr, M J, Chan E C S., Krieg N R, (1986) Microbiology, 5th edn, McGraw-Hill Book Company, NY

2. Ingraham J L, and Ingraham, C L, (2000) Introduction to Microbiology, 2nd edn,Brooks/Cole, Singapore

3. Black J G, (2002) Microbiology: Principles and Explorations, 5th edn, John

Wiley and Sons, Inc. NY

Board of Studies (Microbiology)

(1) Dr. Nikhil S. Bhatt (6) Dr. Srinivas Duggirala

(2) Dr. S. R. Dave (7) Dr. Niraj Sheth

(3) Dr. Devyani Tipre

(4) Dr. Rakesh Patel

(5) Dr. Nupur Goyal

(8) Mrs. Priti Shukla

(9) Mr. Arvind Dungrechia

GUJARAT VIDYAPITH : AHMEDABAD
Faculty of Science and Applied Science, Sadra, Dist: Gandhinagar
Department of Biogas Research and Microbiology
B.Sc. Semester-III

MIC-301 Microbial Physiology

(Syllabus of practical portion) (In force from June, 2019)
(External Evaluation: 60% + Internal Evaluation: 40%)
(Total Teaching Hours=45, Credit=1.5)

LEARNING OUTCOMES:

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

- Know about Culture media, Importance of Media and How it can be prepared artificially in laboratory and what are the composition of different types of culture media
- Get knowledge regarding different qualitative tests for carbohydrates and Proteins
- Know about the effect of antibiotics on growth of bacteria, sensitivity and spectrum activity of antibiotic
- Learn about different biochemical reactions of bacteria and different enzymatic activity of bacteria during growth

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1. Study of different types of media and their ingredients.
   a) Selective media: Rose Bengal agar medium
   b) Differential media: MacConkey's medium, EMB agar medium, triple sugar iron agar medium
   c) Enrichment media: Selenite broth
   d) Enriched media: Blood agar medium, glucose yeast extract agar medium
   e) Natural media: Soil extract agar, potato dextrose agar medium
2. Qualitative analysis of biomolecules:
   a) Carbohydrates: Iodine test, Molisch's test, Benedict's test, Barfoed test, Bial's test and Saliwanoff s test
   b) Proteins: Biurate test, Ehrlich's test, glyoxilic acid test, xanthoproteic test.
3. Determination of absorption maxima of a colored solution (use methylene blue 1:20,000 dilution)
4. Study of effect of antibiotics on bacteria
   a) Study of sensitivity spectrum of antibiotic against the test organism by use of paper disc method
   b) Determination of spectrum of activity of an antibiotic by use of agar ditch method
5. Study biochemical reaction of bacteria
   A. Based on carbon source
      i. Oxidative and fermentative breakdown of glucose
      ii. Fermentation of sugars and sugar alcohol: glucose, xylose, mannitol, lactose,

maltose and sucrose

iii. Glucose breakdown product: Methyl red test, Voges-Proskauer's test

iv. Citrate utilization test

v. Starch utilization test

vi. Lipid utilization test

B. Based on nitrogen source

D. Other tests

a. Catalase test
b. Dehydrogenase test
c. Oxidase test

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GUJARAT VIDYAPITH : AHMEDABAD
Faculty of Science and Applied Science, Sadra, Dist: Gandhinagar
Department of Biogas Research and Microbiology
B.Sc. Semester-III
MIC-302 Soil and Water Microbiology

(Syllabus of theoretical portion) (In force from June, 2019)
(External Evaluation: 60% + Internal Evaluation: 40%)
(Total Teaching Hours=45, Credit=03)

Learning Outcomes

- Get a knowledge of various aspects water and soil
- Students will be introduced to the dynamics of soil biota, the importance of different microbial populations,
- Will become aware of the important role microorganisms play in bio-geochemical cycling of essential elements occurring within an ecosystem and its significance.
- Will understand how microbes interact among themselves and with higher plants and animals with the help of various examples.
- Understand Microorganisms responsible for water pollution especially Water-borne pathogenic microorganisms and their transmission.
- Will gain in-depth knowledge of different types of solid wastes and their management with emphasis on advantages and disadvantages of various methods used for their treatment.
- Acquire knowledge about composition and strength of sewage and its treatment using primary, secondary and tertiary methods.

UNIT 1. Microbiology of Soil (11 Hours)

1. Physicochemical characteristics of soil, soil as a culture medium **(1 Hour)**
2. Soil microflora: Diversity in soil microflora **(2 Hours)**
3. Methods of studying soil micro flora: **(4 Hours)**
   a) Direct microscopic method, agar plate technique, enrichment culture technique, and buried slide method
   b) Use of Winogradsky column in studying microbial diversity in soil
4. Microbial interactions in soil **(4 Hours)**
   a) Neutral, positive and negative associations
   b) Interaction between plant roots and microorganisms:
      i. Rhizosphere and its significance
      ii. Mycorrhiza and root nodule formatio

UNIT 2. Microorganisms as Biogeochemical Agents (11 Hours)

1. Introduction to biogeochemical transformations in soil: Mineralization and immobilization of elements **(3 Hours)**
2. Rotation of elements in nature **(5 Hours)**
   a) Nitrogen cycle: Proteolysis, ammonification, nitrification, denitrification and nitrogen fixation

b) Sulfur cycle: Sulfur oxidation and reduction
c) Carbon cycle: Degradation of complex organic compounds, carbon dioxide fixation, humus and its significance
d) Iron cycle: Iron oxidation and reduction
e) Phosphorus cycle: Mineralization, immobilization and solubilization of phosphorus

3. Soil fertility: Role of microorganisms in soil fertility, biofertilizers **(3 Hours)**

UNIT 3. Microbiology of Drinking Water **(12 Hours)**

1. Natural waters: Sources of contamination
2. Microbial indicators of fecal pollution **(3 Hours)**
   a) Coliforms as indicator, need for differentiation
   b) Methods of differentiation: IMViC test and Elevated temperature test
   c) Microbial indicators other than coliforms
3. Nuisance organisms in water: Slime forming bacteria, iron and sulfur bacteria and algae **(2 Hours)**
4. Water-borne diseases **(2 Hours)**
5. Bacteriological examination of drinking water **(3 Hours)**
   a) Sampling
   b) Quantitative analysis: Standard plate count
   c) Qualitative analysis: Multiple tube fermentation method (presumptive, confirm and completed test), MPN, membrane filter technique, defined substrate test, P-A (Presence-Absence) test
6. Purification of drinking water: Sedimentation, filtration and disinfection **(2Hours)**

UNIT 4. Microbiology of Wastewater **(11 Hours)**

1. Types of wastewater, chemical and microbiological characteristics of waste water **(3 Hours)**
2. BOD, COD and TOD as indicators of strength of wastewater, pollution problems due to disposal of untreated wastewater **(3 Hours)** **(5 Hours)**
3. Methods of wastewater treatment
4. a) Primary treatment and secondary treatment: Principles and role of microorganisms in septic tank, Imhoff tank, trickling filters, activated sludge process, oxidation ponds
   b) Advanced treatment and final treatment
   c) Solid waste processing: Anaerobic sludge digestion and composting
   d) Efficiency of wastewater treatment procedures

Text Books:

1. Pelczar Jr. M J, Chan ECS, Krieg N R, (1986), Microbiology, 5th edn, McGraw-Hill Book Company, NY
2. Alexander M, (1977), Soil Microbiology, 2nd edn. Krieger Publ. Co., Melbourne, FL

3. Atlas R M., (1997), Principles of Microbiology. 2nd edn. Wm. C. Brown Pub., Iowa, USA

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(9) Mr. Arvind Dungrechia

GUJARAT VIDYAPITH : AHMEDABAD
Faculty of Science and Applied Science, Sadra, Dist: Gandhinagar
Department of Biogas Research and Microbiology
B.Sc. Semester-III
MIC-302 Soil and Water Microbiology

(Syllabus of Practical portion) (In force from June, 2019)
(External Evaluation: 60% + Internal Evaluation: 40%)
(Total Teaching Hours=45, Credit=1.5)

Learning Outcomes

- Students will learn the microbiological analysis of soil sample,
- Will learn how to isolate specific microorganisms from soil
- Students will learn the microbiological analysis of water sample,

1. Microbiological analysis of soil
    a. Enumeration of organisms from soil (standard plate count from soil)
    b. Isolation of symbiotic & non-symbiotic nitrogen fixing bacteria & actinomycetes from soil
2. Microbiological analysis of drinking water
    a. Standard plate count of drinking water
    b. Detection of fecal pollution of water by performing presumptive test, confirmed test and completed test
3. Determination of MPN of coliforms in water

Board of Studies (Microbiology)

(1) Dr. Nikhil S. Bhatt
(2) Dr. S. R. Dave
(3) Dr. Devyani Tipre
(4) Dr. Rakesh Patel
(5) Dr. Nupur Goyal
(6) Dr. Srinivas Duggirala
(7) Dr. Niraj Sheth
(8) Mrs. Priti Shukla
(9) Mr. Arvind Dungrechia

Scheme for Examination

1. Microbiological analysis of soil / water (any one) **15**

   a) Standard plate count of water / soil sample
   b) Determination of MPN for coliforms in water sample
   c) Presumptive and confirmed test for water
   d) Confirmed and completed test for water

2. Biochemical reactions of bacteria (any five) **10**

3. General Exercise: (any one) **10**

   a) Study of effect of antibiotics on test organism by paper disc method
   b) Determination of spectrum of activity of an antibiotic by use of agar ditch method
   c) Determination of absorption maxima
   d) Qualitative analysis of protein or carbohydrates
   e) Study of cultural and morphological characteristic of actinomycetes
   f) Cultivation and study of nitrogen fixing bacteria from soil

4 Spotting **10**

5 Viva **10**

6 Journal and slides **05**

GUJARAT VIDYAPITH : AHMEDABAD
Faculty of Science and Applied Science, Sadra, Dist: Gandhinagar
Department of Biogas Research and Microbiology
B.Sc. Semester-III
CHEM-301: Organic Chemistry
(Syllabus of theoretical portion) (In force from June, 2019)
(External Evaluation: 60% + Internal Evaluation: 40%)
(Total Teaching Hours=45, Credit=03)

Learning Outcomes:
After studying this paper student will be able to.....

•define stereochemistry and stereoisomerism electrophilic and nucleophilic substitution reactions , amino acids, Zwitter ion , Isoelectric point and resonance energy
•name the molecule according to E-Z nomenclature/ R-S nomenclature
• explain conformational analysis of ethane and n-butane
•distinguish enantiomers, diastereomers, mesocompounds
•understand mechanism of nitration, sulphonation, halogenation, friedal craft alkylation, friedal craft acylation
•explain orientation of second group in monosubstituted benzene and third group in disubstituted benzenes
• designate D and L to amono acids theoriticaly.
•know geometry of peptide linkages
• understand determination of structure of peptides
•describe strategy of peptide synthesis
•know primary, secondary, tertiary and qutternary structure of proteins
•draw the resonance structures of various molecules
•state the criteria for aromaticity

Note: Each unit must be given equal weightage in examinations

Unit-1(A): Stereochemistry (8 Hours)

1(A).1 Definition of stereochemistry and stereoisomerism **(0.5hour)**
1(A).2 Configurational isomers: cis-trans isomers (for acyclic and cyclic compounds) **(0.5hour)**
1(A).3 E-Z nomenclature **(1hour)**
1(A).4 Chirality **(1hour)**
1(A).5 Configurational isomers: isomers with one and more than one chiral centre (Lactic acid, Tartaric acid, 2,3-dibromopentane, 3-chloro-2-butanol) – enantiomers, diastereomers, mesocompounds**(2hours)**
1(A).6 R-S nomenclature (one and more than one chiral centre) **(2hours)**
1(A).7 Conformational analysis of ethane and n-butane only **(1hour)**

References

1. Organic Chemistry (sixth edition), Robert Thornton Morrison and Robert Neilson Boyd, Prentice-Hall of India Pvt. Ltd., New Delhi,(1999)
2. Organic Chemistry (second edition), Paula YurkanisBruice, Prentice-Hall, Inc., New Jersey (1998)

Unit-1(B): Aromatic substitution reaction (7Hours)

1(B).1 Introduction about electrophilic and nucleophilic substitution reactions **(1hour)**

1(B).2 Electrophilic reagent / electrophilic substitution reaction **(0.5hour)**

1(B).3 Mechanism of nitration, sulphonation, halogenation, friedal craft alkylation, friedal craft acylation **(2hours)**

1(B).4 Classification of substituents groups **(0.5hour)**

1(B).5 Theory of orientation of second group in monosubstituted benzene **(1hour)** [first substituent is activating / deactivating group]

1(B).6 Orientation of third group in disubstituted benzenes **(0.5hour)**

1(B).7 Conversion [reactions form] based on above topics **(1.5hours)**

References

1 .Organic Chemistry (sixth edition), Robert Thornton Morrison and Robert Neilson Boyd, Prentice-Hall of India Pvt. Ltd., New Delhi (1999)

Unit-2: Aminoacids,Peptides and Protein (15 Hours)

2.1 General structure of aminoacids **(1hour)**

2.2 Classification and nomenclature of amino acids**(1hour)**

2.3 Configuration of amino acids: D and L notation **(1hour)**

2.4 Preparation of amino acids: Amination of α-haloacids, Gabriel phthalamide synthesis, strecker synthesis **(2hours)**

2.5 Zwitter ion (dipolar ion) **(1hour)**

2.6 Isoelectric point of amino acids **(1hour)**

2.7 Reaction of amino acid with ninhydrine (not structural reaction) **(1hour)**

2.8 Peptide linkage (dipeptides, tripeptides, polypeptides) **(1hour)**

2.9 Geometry of peptide linkages **(1hour)**

2.10 Determination of structure of peptides **(2hours)**

- N-terminal residue analysis (DNFB method, Phenyl isothiocynate method)
- C-terminal residue analysis(by thiohydantoin and with carboxypeptidase enzyme)

2.11Work out the sequence of amino acid residues from given peptides **(1hour)**

2.12 The strategy of peptide synthesis (Benzyloxycarbonyl method)**(1hour)**

2.13Overview of primary, secondary,tertiary and quternary structure of proteins**(1hour)**

References

1. Organic Chemistry (sixth edition), Robert Thornton Morrison and Robert Neilson Boyd, Prentice-Hall of India Pvt. Ltd., New Delhi,(1999)
2. Organic Chemistry (second edition), Paula Yurkanis Bruice, Prentice-Hall, Inc., New Jersey (1998)
3. Organic Chemistry (third edition), Francis A. Carey, The McGraw-Hill Companies, Inc., New York (1996)

Unit-3: Electron delocalization, Resonance and Aromaticity

(15 Hours)

3.1 Delocalization electron and resonance **(1 hour)**
3.2 How to draw resonance contributors: rules for drawing resonance contributors **(3 hours)**
3.3 The resonance hybrid **(2 hours)**
3.4 Resonance energy **(1 hour)**
3.5 Stability of allylic and benzylic cations **(2 hours)**
3.6 Stability of allylic and benzylic radicals **(2 hours)**
3.7 Criteria for aromaticity **(1hours)**
3.8 Aromaticity **(2 hours)**
3.9 Antiaromaticity **(1 hour)**

References

1.. Organic Chemistry (second edition), Paula Yurkanis Bruice, Prentice-Hall, Inc., New Jersey (1998)
2. Organic Chemistry (sixth edition), Robert Thornton Morrison and Robert Neilson Boyd, Prentice-Hall of India Pvt. Ltd., New Delhi,(1999)

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Board of Studies(Chemistry)

(1) Prof.(Dr.) Nikhil S. Bhatt

(2) Dr. Dasharath P. Patel

(3) Dr. Yogesh S. Patel

(4) Dr. Hitesh J. Shah

(5) Dr. Ketul N.Patel

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

GUJARAT VIDYAPITH : AHMEDABAD
Faculty of Science and Applied Science, Sadra, Dist: Gandhinagar
Department of Biogas Research and Microbiology
B.Sc. Semester-III
CHEM-301: Organic Chemistry
(Syllabus of practical portion) (In force from June, 2019)
(External Evaluation: 60% + Internal Evaluation: 40%)
(Total Teaching Hours=45, Credit=1.5)

Learning Outcomes:
After performing following practicals student will be able to.....
• determine nature of organic compounds
• detect the N, S, X in organic compounds
• identify functional group in organic compounds
• identify organic compound

Qualitative analysis of organic compounds (45 hours)

Candidates are expected to perform the following tests for the organic compounds

(1) Nature of compound: acidic, basic, phenolic, neutral based on solubility tests
(2) Presence of elements: Lassaigne's test (C, H, N,S,X)
(3) Identification of functional groups:

-COOH	>C=O
-OH (alcoholic)	$-NH_2$
-OH (phenolic)	$-NO_2$
-CHO	$-CONH_2$
-CH	-X

(4) B.P. / M.P.
(5)Identification of compound

List of organic compounds for qualitative analysis

Compounds	**Acidic**	**Basic**	**Phenolic**	**Neutral**
C, H, O elements	Tartaric acid Citric acid Phthalic acid Benzoic acid Oxalic acid Succinic acid	xxxxxxxxx	Phenol α-Naphthol β-Naphthol Resorcinol	Methanol Ethanol Benzaldehyde Acetone Acetophenone Benzene Toluene Naphthalene
C, H, O, N elements	Anthranilic acid p-Nitrobenzoic acid	Aniline o-Nitroaniline m-Nitroaniline p-Nitroaniline α-Naphthylamine	o-Nitrophenol p-Nitrophenol	Acetamide Benzamide Nitrobenzene Urea
C, H, O, N, S elements	xxxxxxxxx	xxxxxxxxx	xxxxxxxxx	Thiourea
C, H, O, X elements	xxxxxxxxx	xxxxxxxxx	xxxxxxxxx	Chloroform Carbontetrachloride Chlorobenzene Bromobenzene

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CHEM-301: Organic Chemistry

(Syllabus of practical portion) (In force from June, 2019)

Board of Studies(Chemistry)

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GUJARAT VIDYAPITH : AHMEDABAD
Faculty of Science and Applied Science, Sadra, Dist: Gandhinagar
Department of Biogas Research and Microbiology
B.Sc. Semester-III
CHEM-302: Analytical Chemistry
(Syllabus of theoretical portion) (In force from June, 2019)
(External Evaluation: 60% + Internal Evaluation: 40%)
(Total Teaching Hours=45, Credit=03)

Learning Outcomes:
After studying this paper student will be able to.....
• compare the chemical and instrumental methods for analysis.
• know importance of literatures of analytical chemistry
•describe types of EDTA titrations
•differentiate masking and demasking agents
•understand neutralization titrations of acid-base by pH metry
•explain applications of acid-base titrations
•calculate pH or pOH at all stages of pHmetric acid-base titrations.
•describe Beer's law
• know the types of electronic transitions
•understand Chromophore , Auxochrome and Bathochromic effect, Hypsochromic shif, Hyperchromic effect, Hypochromic effect

Note: Each unit must be given equal weightage in examinations

Unit-1(A): Introduction of analytical chemistry (7 Hours)

1(A).1 Role of analytical chemistry **(1hour)**
1(A).2 Classification of analytical methods: chemical and instrumental methods **(1hour)**
1(A).3 Advantages and limitations of chemical and instrumental methods **(3hours)**
1(A).4 Literatures of analytical chemistry **(1hour)**
1(A).5 Safety in analytical / chemistry laboratory **(1hour)**

References

1.Fundamental of Analytical Chemistry (seventh edition), Douglas A.Skoog, Donald M.West and F.James Holler, Saunders college publishing, New York, pp. 1-10,81(1996)
2.Anatytical Chemistry(sixth edition), Gray D.Christain, John Wiley and Sons,Inc., Singapore, pp.1-14(2003)

Unit-1(B): Complexometric titrations (8Hours)

1(B).1 Introduction **(0.5hour)**
1(B).2Classification of ligands **(0.5hour)**
1(B).3 Structure and acidic properties of EDTA **(0.5hour)**
1(B).4 Complexes and formation constant: How stable are complexes? **(1hour)**
1(B).5 Effect of pH on EDTA equilibria**(1hour)**
1(B).6 Types of EDTA titrations: direct titration, back titration, substitution titration **(1hour)**

1(B).7 Indicators for EDTA titrations / metal ion indicators **(2hours)**
- working mechanism
- Preliminary information of metal ion indicators- Murexide, Eriochrome black T, xylenol orange

1(B).8 Masking and demasking agents **(1.5hours)**

References

1. Anatytical Chemistry (sixth edition), Gray D.Christain, John Wiley and Sons,Inc., Singapore, pp.294-312(2003)
2. Fundamental of Analytical Chemistry (seventh edition), Douglas A.Skoog, Donald M.West and F.James Holler, Saunders college publishing, New York, pp. 278-302(1996)
3. Vogel′s Text Book of Quantitative Chemical Analysis (fifth edition), Longman Scientific and Technical Publish Group, England, pp. 309-323 (1991)

Unit-2: Acid-base titrations **(15 Hours)**

2.1 Introduction **(1hour)**
2.2 Neutralization of strong acid with a strong base by pH metry**(2hours)**
2.3 Neutralization of weak acid with a strong base by pH metry**(2hours)**
2.4 Neutralization of weak base with a strong acid by pH metry**(2hours)**
2.5 Titration of mixture of strong acid and weak acid / base by pH metry**(1hour)**
2.6 Comparative study of different nature of curves for 2.2 to 2.5 **(1hour)**
2.7 Acid-base indicators: definition, theory and Henderson-Hasselbach equation **(1hour)**
2.8 Application of acid-base titrations **(2hours)**
- -Reagents for neutralization titrations: preparation and standardization of acids / bases
- -The determination of inorganic substances (ammonium salts, nitrates and nitrites, carbonates and carbonate mixtures)
- -The determination of organic functional groups (carboxylic and sulphonic acid groups, amine groups, ester groups, hydroxyl groups (Phenolic), carbonyl groups)

2.9 Numerical based on 2.2 to 2.4, 2.7 **(3hours)**

References

1. Anatytical Chemistry (sixth edition), Gray D.Christain, John Wiley and Sons,Inc., Singapore, pp.266-286(2003)
2. Fundamental of Analytical Chemistry (seventh edition), Douglas A.Skoog, Donald M.West and F.James Holler, Saunders college publishing, New York, pp. 248-265 (1996)

Unit-3: Fundamentals of Spectrophotometry **(15 Hours)**

3.1 Property of Light and Electromagnetic spectrum **(1hour)**
3.2 How does matter absorb radiation? **(1hour)**
3.3 What happen when a molecule absorbs light? **(1hour)**
3.4 Beer's law : Relation between absorbed radiation and concentration **(2hours)**
3.5 Numerical based on Beer's law **(2hours)**
Ultra -violet and Visible Spectroscopy
3.6 Basic Principle of instrumentation (Choice of source,monochromator and detector) for single and double beam **(2hours)**
3.7 Types of electronic transitions **(2hours)**
3.8 Chromophore and Auxochrome concept **(2hours)**

3.9 Absorption and intensity shifts(Bathochromic effect, Hypsochromic shift, Hyperchromic effect, Hypochromic effect) **(2hours)**

References

1.Quantitative Chemical Analysis (seventh edition), Daniel C. Harris, W.H.Freeman and Company, New York (2007).
2.Elementary Organic Spectroscopy, Y.R.Sharma, S. Chand & Company Ltd.,Delhi(2007)

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B.Sc. Semester-III
CHEM-302: Analytical Chemistry
(Syllabus of theoretical portion) (In force from June, 2019)

Board of Studies(Chemistry)

(1) Prof.(Dr.) Nikhil S. Bhatt

(2) Dr. Dasharath P. Patel

(3) Dr. Yogesh S. Patel

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GUJARAT VIDYAPITH : AHMEDABAD
Faculty of Science and Applied Science, Sadra, Dist: Gandhinagar
Department of Biogas Research and Microbiology
B.Sc. Semester-III
CHEM-302: Analytical Chemistry
(Syllabus of practical portion) (In force from June, 2019)
(External Evaluation: 60% + Internal Evaluation: 40%)
(Total Teaching Hours=45, Credit=1.5)

Learning Outcomes:
After performing following practicals student will be able to.....
• prepare and standardize $KMnO_4$, $K_2Cr_2O_7$,EDTA, $AgNO_3$ solutions
• do acid-base titrations by pH meter and Conductivity meter

(A) Solution preparation and standardization (30 Hours)

(1) Preparation and standardization of potassium permanganate solutions (approximately 0.05N) **(3 hours)**
(2) To determine normality of given ferrous ammonium sulphate / ferrous sulphate solution using standard potassium permanganate solutions **(3 hours)**
(3) Preparation and standardization of potassium dichromate solutions (approximately 0.05N) **(3 hours)**
(4)To determine normality of given ferrous ammonium sulphate / ferrous sulphate solution using standard potassium dichromate solutions **(3 hours)**
(5) Preparation and standardization of sodium thiosulphate solutions (approximately 0.1N) **(3 hours)**
(6)To determine normality of given iodine solution using standard sodium thiosulphate solutions**(3 hours)**
(7)Preparation and standardization of EDTA solutions (approximately 0.01N) **(3 hours)**
(8)To determine normality of given $MgCl_2$ solution using standard EDTA solutions **(3 hours)**
(9)Preparation and standardization of silver nitrate solutions (approximately 0.02N) **(3 hours)**
(10)To determine normality of given KCl solution using standard silver nitrate solutions **(3 hours)**

(B) Acid-base titrations by pH metrically and conductometrically (15 Hours)

(1) HCl→NaOH**(6 hours)**
(2) CH_3COOH →NaOH**(6 hours)**
(3) HCl + CH_3COOH →NaOH (by pH metrically only) **(3 hours)**

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Board of Studies(Chemistry)

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GUJARAT VIDYAPITH: AHMEDABAD

Department of Biogas Research and Microbiology

Faculty of Science and Applied Science, Sadra, Dist: Gandhinagar

B.Sc. Semester III

DSE 301: Biomathematics and Biostatistics

(Syllabus of theoretical portion) (In force from June 2018)

(Total Marks: 100 (Internal Evaluation: 40 Marks, External evaluation 60 Marks)

Credit: 03+00,

Teaching hours: 45

Learning Outcomes:

- Understand the fundamental principles of descriptive statistics and statistical inference.
- Understand the general principles underlying the most common tests.
- Know the assumptions of common test and understand impact of violations.
- Be able to perform standard statistical analyses.

UNIT 1 Representation of Data **15 hr**

Definition and scope of biostatistics, Measures of central tendency (definition), characteristics of ideal measure of central tendency, Mean, mode and median for both ungrouped and grouped data (for discrete and continuous frequency distribution), Empirical relationship among mean, mode and median, Merits, demerits and uses of mean, mode and median, Graphic location of median and mode, Selection of appropriate measure of central tendency, Measures of dispersion- definition, Need of measures of dispersion, Mean deviation and standard deviation

UNIT 2 Probability and Standard Probability distributions **15 hr**

Random experiment, Definition of probability, Elementary properties of probability, mutually exclusive events, Dependant and independent events, Addition rule and multiplication rule for probability (without proof), Conditional probability, Bayes's theorem, Random variable, Discrete and continuous random variables, Probability distributions, Bernoulli trials, Binomial and Poisson distributions and their properties, Mean and variance of these distributions, Recurrence relations for probabilities related to binomial distribution and Poisson distributions, Normal distribution and its properties, standard normal variable, Fitting of binomial, Poisson and normal distributions.

UNIT 3	**Testing of Hypothesis** Need of testing of hypothesis, null and alternative hypothesis, level of significance, Type-I and Type-II errors, t-test for testing the significance of a single mean, t- test for testing the significance of difference between two means, Paired t-test, t-test for testing significance of observed correlation coefficient, Chi-square test for goodness of fit, Chi-square test for testing independence of attributes, Chi-square test for homogeneity.	**15 Hr**

Basic Text & Reference Books:

- Methods in Biostatistics by B.K. Mahajan.
- Statistics (theory, methods, & application) by D. C. Sancheti and V.K.Kapoor
- An Introduction to Biostatistics (Third Ed.) by P.S.S. Sundar Rao and J. Richard.
- Cytology-genetics biotechnology and biostatistics by P.K.Gupta
- Biostatistics by P. N. Arora and P.K.Malhan.
- Fundamentals of Biostatistics by Khan and Khanum
- Statistical methods in biology by Bailey.
- Biostatistics: A foundation for analysis in the health sciences by Daniel.
- Introduction to Mathematics for Life-Sciences by P. Batschelet - Springer - Verlag
- Mathematics for Biological Science by Jagdish Arya and Ladner

અનું. નં.	નામ	સહી
1	ડો. રાજીવ ડી. વૈદ્ય	
2	ડો. ચંદ્રકાંતભાઈ એ. પટેલ	
3	ડો કૌશિક આર. પટેલ	
4	ડો નિખિલ ભટ્ટ	

GUJARAT VIDYAPITH: AHMEDABAD
Department of Biogas Research and Microbiology
Faculty of Science and Applied Science, Sadra, Dist: Gandhinagar
B.Sc. Semester III
DSE 301: Bio Mathematics and Bio statistics
(Syllabus of Practical portion) (In force from June 2018)
(Total Marks: 100 (Internal Evaluation: 40 Marks, External evaluation 60 Marks)
Credit: 00+02
Lab hours: 45

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(1) To convert ungrouped data in to grouped data using Sturge's formula.

(2) To study representation of data by one dimensional diagram.

(3) To study representation of data by two dimensional diagram.

(4) To study representation of data by means of graphs.(Histogram & frequency polygon).

(5) To study the data representation by graphs (Frequency polygon & frequency curve).

(6) To study the concept of permutation and combination in practical counting problems.

(7) To study the concept of normal distribution and apply it to practical problems.

(8) To apply the concept of skewness in the field of biosciences.

(9) To apply the concept of F- test for biological problems.

(10) To apply the concept of χ^2 – test for biological problems.

GUJARAT VIDYAPITH: AHMEDABAD
Faculty of Science and Applied Science, Sadra, Dist. Gandhinagar
Department of Biogas Research and Microbiology
Semester 3: ENG 301: English
Learning Objectives and Syllabus
(External Evaluation: 60% + Internal Evaluation: 40%)
(Total Teaching Hours: 23, Credit: 1.5)

Learning Objectives:

1. To familiarize students with different genres of writings.
2. To develop among students the comprehensive understanding of comprehension passages.
3. To develop among students the skill of writing short notes which are informative in nature.
4. To develop vocabulary which is used to describe a feature of a person or thing.
5. To develop understanding of function of tenses in paragraphs.
6. To develop official written communication skills needed by students and young scholars.
7. To develop academic skills of comprehending texts and lectures/presentations.

Unit 1: Comprehensionand Vocabulary (50%: 10Hours)

1. The Lucheon by W. Somerset Maughm
2. Vanar Jatakam by T. Vijayendra
3. The Fast by M.K. Gandhi

Comprehension:

1. Short questions
2. Short notes
3. Fill in the blanks
4. Antonyms/Synonyms (Based on the Comprehension texts)
5. One Word Substitutes

NB: 1. Short questions as well as short notes should be informative in nature.2. Teacher should provide a list of One Word Substitutes for the students.

Unit 2: Grammar (20%; 7Hours)

1. Future Conditionals
2. Adjectives (Detailed Study)
3. Adverbs (Detailed Study)
4. Prepositions**Unit 3: Writing Skills (30%; 4 Hours)**
1. Leaving Short Messages (On Paper)
2. Composing SMS on Cell Phone
3. Formal Letter Writing (Asking for Leave, Scholarship, Complaint)
4. Formal Emails (Asking for Leave, Scholarship, Complaint)

Unit 4: Academic Skills (20%; 3 Hours)

1. Note-taking
2. Note-making
3. Summarizing

List of Reference Books:

Achar, Deeptha et al. Eds. *English for Academic Purposes Book –1*. Gandhinagar: University
Granthnirman Board, 2011.
Achar, Deeptha et al. Eds. *English for Academic Purposes Book –1*. Hyderabad: Orient Black Swan,
2012.

Achar, Deeptha et al. Eds. *English for Academic Purposes Book –2*. Gandhinagar: University
Granthnirman Board, 2011.
Achar, Deeptha et al. Eds. *English for Academic Purposes Book –2*. Hyderabad: Orient Black Swan,
2013.
Gandhi, M. K. Gandhi. *An Autobiography Or The Story of My Experiments with Truth.* Ahmedabad:
Navjivan, 2011.
Tickoo, M. L. et al. Eds. *I Am The People: English Reader*. Delhi: CBSE, 1996.
Vijayendra, T. *An Intelligent Bird's Guide to the Birdwatcher and Other Stories.* Udupi: Sangatya,
2014.
Wren, P. C. and H. Martin. *High School English Grammar and Composition*. (Gujarati). Trans. Dr.
Usha Upadhyay and Jegeesha Upadhyay. New Delhi: S. Chand, 2013.

GUJARAT VIDYAPITH : AHMEDABAD
Faculty of Science and Applied Science, Sadra, Dist: Gandhinagar
Department of Biogas Research and Microbiology
B.Sc. Semester-IV

MIC-401 Microbial Biodiversity

(Syllabus of theoretical portion) (In force from December, 2019)
(External Evaluation: 60% + Internal Evaluation: 40%)
(Total Teaching Hours=45, Credit=03)

LEARNING OUTCOMES:

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

- Understand the concept of Biodiversity ,evolution and origin of Biodiversity and Gain knowledge about Methods of Assessment of Biodiversity
- know about comparative biodiversity of Bacteria, Archaea, Eukaryotic cell and Acellular Microorganisms

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UNIT 1. Introduction **(11 Hours)**

1. What is biodiversity? **(1 Hour)**

2. Origin of life, evolution and origin of biodiversity, species concept **(3 Hours)**

3. Evolutionary tree of microorganisms **(3 Hours)**

4. Value of biodiversity, microbial biodiversity as index of environmental change **(4 Hours)**

UNIT 2. Methods of Assessing Biodiversity **(11 Hours)**

1. Microscopic methods **(3 Hours)**

2. Cultural methods **(4 Hours)**

3. Molecular and genomic methods: Molecular context of microbial diversity, importance of DNA and r RNA sequence comparison, determination of GC content **(4 Hours)**

UNIT 3. Biodiversity among Bacteria & Archaea **(12 Hours)**

1. Morphological and cellular diversity **(3 Hours)**

a. Diversity in major cell shape and grouping

b. Diversity in ultra structure of cell with reference to cell envelope, cell membrane, cell wall, surface appendages, other cell organelles and spore.

2. Physiological and metabolic diversity **(4 Hours)**

a. Diversity in photosynthetic, heterotrophic and autotrophic metabolism

3. Ecological diversity **(5 Hours)**

a. Diversity in major ecosystems b. Diversity in aquatic, marine and extreme environment

UNIT 4. Biodiversity among Eukaryotic and Acellular Microorganisms

(11 Hours)

1. Eucarya: Morphological, cellular, physiological, metabolic and ecological characteristics of **(8 Hours)**

a. Protozoans

b. Slime molds

c. Fungi

d. Algae

e. Lichens as consortium of algae and fungi

2. Acellular organisms: Viruses and prions **(3 Hours)**

Text Books:

1. Cambell R., (1983), Microbial Ecology, 2nd edn. Blackwell Scientific Publications, London
2. Ogunseitan O., (2005) Microbial Diversity: Form and Function in Prokaryotes, Blackwell Publishing, Malden, MA, Oxford, Victoria
3. Atlas R M, Bartha R., (1998), Microbial Ecology: Fundamentals & Applications. 4th edn. Pearson Education.

Board of Studies (Microbiology)

(1) Dr. Nikhil S. Bhatt

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(3) Dr. Devyani Tipre

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GUJARAT VIDYAPITH : AHMEDABAD
Faculty of Science and Applied Science, Sadra, Dist: Gandhinagar
Department of Biogas Research and Microbiology
B.Sc. Semester-IV

MIC-401 Microbial Biodiversity

(Syllabus of Practical portion) (In force from June, 2018)
(External Evaluation: 60% + Internal Evaluation: 40%)
(Total Teaching Hours=45, Credit=1.5)

LEARNING OUTCOMES:

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

- Understand the ecological diversity of bacteria at extreme ecological conditions
- Get skill cultivation techniques of extremophiles
- Know the soil biodiversity by using Winogradsky column
- Know the morphological and cultural, Metabolic diversity of different bacteria
- Understand the diversity of different eukaryotic organisms

1. Study of ecological diversity amongst bacteria at extreme conditions: Cultivation of acidotolerant (pH-4), alkalitolerant (pH-8), halotolerant (NaCl 10%), thermotolerant (temp:50 °C) bacteria [Cultivation using nutrient broth (as basal medium) at different environmental variable(s), results to be observed in form of turbidity followed by Gram's staining. Use routine nutrient broth as control tube. Soil sample to be used for cultivation].
2. Study of microbial diversity in soil by using Winogradsky Column (Demonstration only)
3. Study of morphological and cultural diversity of *Escherichia coli, Enterobacter aerogenes, Staphylococcus aureus, Bacillus subtilis, Bacillus megaterium and Bacillus cereus*.
   a) Study of morphological diversity by performing Gram's staining, capsule staining and spore staining.
   b) Study of cultural / growth diversity using nutrient broth and nutrient agar media

4. Study of metabolic diversity amongst bacteria: *Escherichia coli, Enterobacter aerogenes, Proteus vulgaris, Staphylococcus aureus, and Bacillus subtilis* by performing various biochemical tests:

A. Based on carbon metabolism

I. Methyl Red Test ii. Voges-Proskauer (V-P) test
II. Fermentation of sugars and sugar alcohol: glucose, xylose, mannitol, lactose, maltose and sucrose
III. Citrate utilization test
IV. Starch utilization test

v. Lipid utilization test

B. Based nitrogen metabolism

i. Indole production test
ii. H_2S production test
iii. Urea utilization test
iv. Casein hydrolysis test
v. Gelatin hydrolysis test

C. Presence of respiratory enzymes

i. Catalase test
ii. Dehydrogenase test
iii. Oxidase test

5. Study of diverse groups of eukaryotic microorganisms

A. Fungi: Cultural and microscopic characters of Mucor, Rhizopus, Aspergillus, Penicillium and yeast
B. Algae: Study of algae present in pond water; study of permanent slides of spirogyra and diatoms
C. Protozoa: Study of presence of protozoa in pond water; study of permanent slides of Amoeba, Euglena and Paramecium

Board of Studies (Microbiology)

(1) Dr. Nikhil S. Bhatt
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GUJARAT VIDYAPITH : AHMEDABAD
Faculty of Science and Applied Science, Sadra, Dist: Gandhinagar
Department of Biogas Research and Microbiology
B.Sc. Semester-IV

MIC-402 Food and Dairy Microbiology

(Syllabus of theoretical portion) (In force from December, 2019)
(External Evaluation: 60% + Internal Evaluation: 40%)
(Total Teaching Hours=45, Credit=03)

Learning Outcomes

- Will be aware of the possible sources of contamination of foods and the parameters affecting microbial growth in foods
- Will gain insight into the microbial spoilage of some foods
- Will acquire an in-depth knowledge of various physical and chemical methods used for food preservation
- Will be acquainted with microbial production of fermented dairy and non-dairy food products. Will also be able to understand the health benefits of prebiotics, probiotics and synbiotics
- Will be conversant with some food-borne diseases
- Will be able to understand the concept of HACCP of food

UNIT 1. Microbes in Food Infection and Poisoning **(11 Hours)**

1. Food as a substrate for microorganisms **(1 Hour)**

2. Microbial flora of foods: Milk, fruits, vegetables, meat, eggs **(2 Hours)**

3. Factors affecting kinds and numbers of microorganisms, intrinsic and extrinsic factors **(2 Hours)**

4. Food and milk borne infections **(3 Hours)**

   a) Sources of contamination
   b) Major food and milk borne diseases

5. Food poisoning **(3 Hours)**

   a) Microorganisms involved, sources of contamination
   b) Role of Staphylococcus aureus, Clostridium botulinium and Salmonella spp
   c) Molds as poisoning agents

UNIT 2. Microbial Food Spoilage and Preservation **(11 Hours)**

1. Microbial Spoilage of food **(4 Hours)**

   a) Causes of spoilage
   b) Biochemical changes caused by microbes
   c) Spoilage of milk and milk products, fruits, vegetables, eggs, meat
   d) Spoilage of canned foods

2. Preservation of food and Milk **(7 Hours)**

   a) General principles
   b) Methods of preservation

      i. Use of aseptic handling

ii. High temperature: Pasteurization, sterilization, canning

iii. Low temperature: Refrigeration and freezing

iv. Dehydration

v. Osmotic pressure

vi. Preservatives

vii. Radiations: Ionizing and non-ionizing radiation

UNIT 3. Microbes as Food and Food Products **(11 Hours)**

1. Fermented dairy products **(7 Hours)**

a) Starter culture
b) Cheese: Types, curdling, processing, ripening
c) Other fermented dairy products Yogurt, cultured buttermilk, acidophilus milk, Kefir and cultured sour milk
d) Introduction to probiotics, prebiotics and synbiotics

2. Indian fermented food products: Pickles, idli, Khaman and bread **(2 Hours)**

3. Microbes as food: Mushrooms, spirulina and yeasts **(2 Hours)**

UNIT 4. Methods in Food Microbiology **(12 Hours)**

1. Biological methods: Generalized scheme for microbiological examination **(4 Hours)**

a) Direct microscopic examination, colony forming units (CFU)
b) Most probable number (MPN),
c) Identification of specific group or species of microorganisms

2. Bacteriological analysis of milk **(5 Hours)**

a) Grading of milk: Resazurin test
b) Determination of efficiency of pasteurization: Phosphatase test
c) Determination of MPN
d) Acid-fast staining

3. Microbiological criteria of food safety **(3 Hours)**

Text Books:

1. Pelczar Jr, M J, Chan E C S, Krieg N R, (1986), Microbiology: An Application Based Approach, 5th edn. McGraw-Hill Book Company, NY
2. Frazier W C and Westhoff D C (1988), Food Microbiology, 4th edn. McGraw-Hill Book Company, NY.
3. Prescott L, Harley J P, and Klein D A, (2008), Microbiology, 7th edn. Wm C. Brown - McGraw Hill, Dubuque, IA.

Board of Studies (Microbiology)

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GUJARAT VIDYAPITH : AHMEDABAD
Faculty of Science and Applied Science, Sadra, Dist: Gandhinagar
Department of Biogas Research and Microbiology
B.Sc. Semester-IV

MIC-402 Food and Dairy Microbiology

(Syllabus of Practical portion) (In force from December, 2019)

(External Evaluation: 60% + Internal Evaluation: 40%)
(Total Teaching Hours=45, Credit=1.5)

Learning Outcomes

- Through bacteriological analysis of milk and food students will obtain information regarding the degree and types of bacterial contamination.
- Through such bacteriological analysis students an known the quality of milk and food.

1. Microbiological analysis of food

   A. Standard plate count of food sample
   B. Determination of MPN of coliforms

2. Microbiological analysis of milk

   A. Standard plate count of milk sample
   B. Determination of microbial load of milk by use of MBRT of raw milk, boiled milk and pasteurized milk
   C. Detection of acid-fast organisms in milk sample

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Semester- IV

Scheme for Examination

Ex Marks

1. Microbiological analysis of food / milk (any one) 15

A. Standard plate count of food / milk sample
B. Determination of MPN for coliforms in food sample
C. Determine microbial load of milk sample by performing MBRT and check for presence of acid-fast bacteria.

2. Diversity in bacteria (any one) 10

A. Study cultural diversity and morphological diversity in given bacterial cultures (two bacterial cultures)
B. Study metabolic diversity based on metabolism of nitrogen source / carbon source / presence of respiratory enzymes of the given bacterial cultures (two bacterial cultures, three tests)

3. Identification of fungi 10

A. Identify the given fungal culture based on its growth and morphological characters.

4. Spotting 10

5. Viva 10

6. Journal and slides 05

GUJARAT VIDYAPITH : AHMEDABAD
Faculty of Science and Applied Science, Sadra, Dist: Gandhinagar
Department of Biogas Research and Microbiology
B.Sc. Semester-IV
CHEM-401: Organic Chemistry
(Syllabus of theoretical portion) (In force from December, 2019)
(External Evaluation: 60% + Internal Evaluation: 40%)
(Total Teaching Hours=45, Credit=03)

Learning Outcomes:
After studying this paper student will be able to..…
- name the heterocyclic compounds and carbohydrates according nomenclature rules
- know the Source of pyrrole,furan, thiophene and pyridine
- understand orbital structure of pyrrole,furan, thiophene and pyridine
- know preparation of pyrrole,furan, thiophene and pyridine
- draw the orbital structure of pyrrole,furan, thiophene and pyridine
- explain relative reactivity toward electrophilic aromatic substitution in pyrrole,furan, thiophene, pyridine and benzene
- designate D and L to carbohydrates theoriticaly.
- draw the configuration of aldose and ketose
- understand general and chemical properties of monosaccharides
- describe the methods of interconversion of sugars
- understand configuation and cyclic structure of glucose
- draw the structure of disaccharides and polysaccharides
- revise various acid-base theories
- explain relation of ionization constant, inductive effect, resonance, hybridization,steric effect and hydrogen bond with strength of organic acids/bases

Note: Each unit must be given equal weightage in examinations

Unit-1: Heterocyclic compounds (15 Hours)

1.1 Introduction **(1hour)**
1.2 Nomenclature of heterocycles: **(3hours)**
-systematic nomenclature system for naming three to ten membered monocyclic hetero cycles of various unsaturation containing one or more hetero atoms
-system of nomenclature is based on the trivial and semitrivial names of heterocycles [Pyrrole, Furan, Thiophene, Selenophene, Pyrazole, Imidazole, Isoxazole, Pyridine, Pyridazine, Pyrimidine, Pyrazine, Pyrene, Indole, Isoindole, Purine, Quinoline, Isoquinoline]
-nomenclature systems for fused heterocycles

Five membered heterocyclic compounds [Pyrrole, Furan, Thiophene]
1.3 Source of pyrrole, furan and thiophene**(1hour)**
1.4 Aromaticity and orbital structure of pyrrole,furan and thiophene**(1hour)**
1.5 Preparation of pyrrole,furan and thiophene**(1hour)**
1.6 Orientation of electrophilic substitution in pyrrole,furan and thiophene**(1hour)**
1.7 Relative reactivity toward electrophilic aromatic substitution in pyrrole, furan, thiophene and benzene**(1hour)**

Six membered heterocyclic compounds [Pyridine]

1.8 Source of pyridine compound **(1hour)**

1.9 Aromaticity and orbital structure of pyridine **(1hour)**

1.10 Basicity of pyridine including comparison with basicity of pyrroleand aliphatic amine **(1hour)**

1.11 Orientation of electrophilic and nucleophilic substitution in pyridine **(2hours)**

1.12 Relative reactivity toward electrophilic aromatic substitution in benzene, pyridine **(1hour)**

References

1. Organic Chemistry (sixth edition), Robert Thornton Morrison and Robert Neilson Boyd, Prentice-Hall of India Pvt. Ltd., New Delhi,(1999)
2. Organic Chemistry (second edition), Paula YurkanisBruice, Prentice-Hall, Inc., New Jersey (1998)

Unit-2: Carbohydrates-I **(15 Hours)**

2.1 Definition and classification **(0.5hour)**

2.2 Nomenclature **(0.5hour)**

2.3 D and L notation **(0.5hour)**

2.4 Configuration of aldose and ketose containing three through six carbon atoms **(2hours)**

2.5 General properties of monosaccharide (Glucose and Fructose): colour, taste, physical state, solubility **(0.5hour)**

2.6 Chemical properties of monosaccharide (Glucose and Fructose): acetylation, oxidation, reduction, cynohydrin formation, oxime formation, osazone formation **(2.5hours)**

2.7 Epimers, epimers of D-glucose, conversion of an aldohexose into its C-2 epimer (mannose) **(1hour)**

2.8 Methods of interconversion of sugars **(2hours)**

- Lengthening the carbon chain of aldoses (The Kiliani Fischer synthesis: aldohexose from aldopentose)
- Shortening the carbon chain of aldoses (The Ruff degradation: aldopentose from aldohexose)

2.9 Configuation of (+) glucose: The Fischer proof **(2hours)**

2.10 Cyclic structure of glucose **(2hours)**

2.11Structure of disaccharides (sucrose, cellobiose, maltose, lactose) and polysaccharides (starch and cellulose) excluding their structure elucidation. **(1.5hour)**

References

1. Organic Chemistry (sixth edition), Robert Thornton Morrison and Robert Neilson Boyd, Prentice-Hall of India Pvt. Ltd., New Delhi,(1999)
2. Principles of Microbiology (second edition), Ronald M. Atlas, Wm.C. Brown Publisher, Iowa, pp.1159-1185 (1997)

Unit-3: Chemical Reactivity and Molecular Structure (Acid-Base Properties) **(15 Hours)**

3.1 Theories of acids and bases **(1hour)**

3.2 pK_a scale: relation between ionization constant K_a (pK_a) , K_b (pK_b) with strength of organic acids and bases**(2hours)**

3.3 Inductive effect and strength of organic acids/ bases**(2hours)**
3.4 Effect of resonance on strength of acids and bases **(3hours)**
3.5 Effect of hybridization on acidity and basicity of organic acids/ bases**(2hours)**
3.6 Role of steric effect on strength of organic acids/bases **(2hours)**
3.7 Effect of hydrogen bond on strength of organic acids**(2hours)**
3.8 Keto-enol tautomerism**(1hour)**

References

1.. Organic Chemistry (third edition), Cram and Hammond, he McGraw-Hill Companies, Inc., New York.
2. Organic Chemistry (sixth edition), Robert Thornton Morrison and Robert Neilson Boyd, Prentice-Hall of India Pvt. Ltd., New Delhi,(1999)

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B.Sc. Semester-IV
CHEM-401: Organic Chemistry
(Syllabus of theoretical portion) (In force from December, 2019)

Board of Studies(Chemistry)

(1) Prof.(Dr.) Nikhil S. Bhatt

(2) Dr. Dasharath P. Patel

(3) Dr. Yogesh S. Patel

(4) Dr. Hitesh J. Shah

(5) Dr. Ketul N.Patel

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GUJARAT VIDYAPITH : AHMEDABAD
Faculty of Science and Applied Science, Sadra, Dist: Gandhinagar
Department of Biogas Research and Microbiology
B.Sc. Semester-IV
CHEM-401: Organic Chemistry
(Syllabus of practical portion) (In force from December, 2019)
(External Evaluation: 60% + Internal Evaluation: 40%)
(Total Teaching Hours=45, Credit=1.5)

Learning Outcomes:
After performing following practicals student will be able to.....

- determine nature of organic mixture
- separate organic compounds from their mixture
- identify separated organic compounds through lassigne's test, functional group test and melting point/boiling point test
- prepare organic compound by oxidation and nitration reactions

(A) Qualitative analysis of organic mixture (33 Hours)

Separation of two components from the mixture of organic compounds using semi-micro method, identification of compounds by lassaigne's test, functional group test, melting point / boiling point test

(1) Acids: Benzoic acid, Salicylicacid, Cinnamic acid, Phthalic acid , Anthranilic acid, Oxalic acid , Tartaric acid, p-nitrobenzoic acid
(2) Phenols: α-Naphthol, β-Naphthol, o-Nitrophenol, p-Nitrophenol, Resorcinol
(3) Amines: p-Toludine, o-Nitroaniline, m- Nitroaniline, p- Nitroaniline
(4) Neutral: Urea, Thiourea, Acetamide, Benzamide, Acetanilide, Glucose, Naphthalene

(B) Preparation of organic compounds and its confirmation by function group test and M.P (with mole ratio calculation) (12Hours)

(1) Oxidation: Benzoic acid from benzaldehyde by $KMnO_4$
(2) Nitration: p-nitroacetanilide from acetanilide

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GUJARAT VIDYAPITH : AHMEDABAD
Faculty of Science and Applied Science, Sadra, Dist: Gandhinagar
Department of Biogas Research and Microbiology
B.Sc. Semester-IV
CHEM-402: Analytical Chemistry
(Syllabus of theoretical portion) (In force from December, 2019)
(External Evaluation: 60% + Internal Evaluation: 40%)
(Total Teaching Hours=45, Credit=03)

Learning Outcomes:
After studying this paper student will be able to..…
- Know about various separation techniques
- understand different chromatographic techniques such as Paper chromatography, Column chromatography, Thin layer chromatography, Ion exchange chromatography and Gas chromatography
- know various steps for gravimetric analysis
- do calculation how much analyte is present in sample
- understand about organic precipitants
- distinguish accuracy and precision
- understand Student's t-test, F-test, Q-test,Correlation coefficient and Linear regression
- solve numerical based on statistics for analytical data

Note: Each unit must be given equal weightage in examinations

Unit-1: Introduction to separation techniques (15 Hours)

1.1 Filtration, distillation and solvent extraction **(2hours)**
1.2 Chromatography: principle, classification of chromatographic methods **(2hours)**
1.3 Paper chromatography: principle, experimental technique **(2hours)**
1.4 Column chromatography: principle, experimental technique **(2hours)**
1.5 Thin layer chromatography: principle, experimental technique **(2hours)**
1.6 Ion exchange chromatography: principle, experimental technique **(1hour)**
1.7 Gas chromatography: principle, experimental technique (except types of detector) **(2hours)**
1.8 Applications of chromatography in qualitative and quantitative analysis **(2hours)**

References

1.Fundamental of Analytical Chemistry (seventh edition), Douglas A.Skoog, Donald M.West and F.James Holler, Saunders college publishing, New York, pp. 660-700(1996)
2. Experimental Organic Chemistry Harcourt (second edition), John C.Gilbertand Stephen F. Martin, Harcourt college publishers, New York, 24-86 and 154-175 (1998)

Unit-2: Gravimetric analysis and precipitation equilibrium

(15 Hours)

2.1 Introduction **(1hour)**
2.2 How to perform a successful gravimetric analysis?
- Preparation of the solution **(1hour)**
- Precipitation **(1hour)**
- Digestion **(1hour)**

- Filtration **(1hour)**
- Washing **(1hour)**
- Drying or igniting **(1hour)**
-Weighing **(0.5hour)**
- Calculation **(0.5hour)**

2.3Gravimetric calculation: How much analyte is there? **(1hour)**

2.4 Organic precipitants **(2hours)**

[Definition, only name and structure of three organic precipitants(Dimethylglyoxime, 8-hydroxyquinoline, Quinaldic acid), advantages and disadvantages of organic precipitants]

2.5 Application of gravimetric analysis **(2hours)**

2.6 Numericals based on 2.3 **(2hours)**

References

1. Anatytical Chemistry (sixth edition), Gray D.Christain, John Wiley and Sons,Inc., Singapore, pp.318-388(2003)
2. Quantitative analysis (sixth edition), R.A.Day, JR.; A.L.Underwood, Prentice-Hall of India Pvt.Ltd., New Delhi, pp.68-91(2003)

Unit-3: Statistics for analytical data **(15 Hours)**

3.1 Limitation of analytical data **(0.5hour)**

3.2 Accuracy and precision **(0.5hour)**

3.3 Measurement of central tendency: mean, median and mode **(1hour)**

3.4 Way of expressing accuracy: absolute error, relative error **(0.5hour)**

3.5 Way of expressing precision: range, deviation, average deviation, relative average deviation, standard deviation, coefficient of variation, variance **(1hour)**

3.6 Types of error in chemical analysis: systematic errors [instrumental error, errors of method, operative errors, personal errors] and random errors **(2hours)**

3.7 The effect of systematic errors on analytical results: constant errors and proportional errors **(1hour)**

3.8 Minimization of errors **(0.5hour)**

3.9 Significant figure and computations **(1hour)**

3.10 Confidence interval **(0.5hour)**

3.11 Student's t-test: Are there difference in the methods? **(1hour)**

-when accepted value is known
-comparison of the means of two samples

3.12 F-test: comparison of precision of two sets of data **(1hour)**

3.13 Rejection of a result: the Q-test **(0.5hour)**

3.14 Correlation coefficient: **(0.5hour)**

- Pearson correlation coefficient

3.15 Linear regression **(0.5hour)**

3.16 Numerical based on all topics **(3hours)**

References

1. Anatytical Chemistry (sixth edition), Gray D.Christain, John Wiley and Sons,Inc., Singapore, pp.65-123(2003)

2.Fundamental of Analytical Chemistry (seventh edition), Douglas A.Skoog, Donald M.West and F.James Holler, Saunders college publishing, New York, pp.11-70(1996)
3. Vogel′s Text Book of Quantitative Chemical Analysis (fifth edition), Longman Scientific and Technical Publish Group, England, pp. 125-149(1991)
4. Quantitative Analysis (sixth edition), R.A.Day Jr. and A.L.Underwood, Prentice-Hill of India Pvt. Ltd., New York, pp. 07-42 (2003)
5. Quantitative Chemical Analysis (seventh edition), Daniel C. Harris, W.H.Freeman and Company, New York (2007).

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B.Sc. Semester-IV
CHEM-402: Analytical Chemistry
(Syllabus of theoretical portion) (In force from December, 2019)

Board of Studies(Chemistry)

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Faculty of Science and Applied Science, Sadra, Dist: Gandhinagar
Department of Biogas Research and Microbiology
B.Sc. Semester-IV
CHEM-402: Analytical Chemistry
(Syllabus of practical portion) (In force from December, 2019)
(External Evaluation: 60% + Internal Evaluation: 40%)
(Total Teaching Hours=45, Credit=1.5)

Learning Outcomes:
After performing following practicals student will be able to.....
- prepare crystals
- separate the mixture of organic liquids by distillation
- do qualitative analysis of inorganic mixture and mixture of aminoacids by paper and thin layer chromatography
- determine metal(Fe, Ni, Ba and Al) content by Gravimetric analysis

(A) Separation techniques (21 Hours)

(1) Crystallizaton **(6hours)**
- Concept of induction of crystallization
- Phthalic acid from hot water
- Acetanilide from boiling water
- Benzoic acid from water
- Naphthalene from ethanol

(2) Distillation **(6hours)**
- Simple distillation of acetone-water mixture using water condenser
- Distillation of nitrobenzene and chlorobenzene using air condenser
- Separation of azeotropic mixture

(3) Chromatography **(Any three experiments) (9hours)**
- To separate Pb^{2+}, Ag^{+} and Hg^{2+}ions present in a mixture by paper chromatography
- To separate Zn^{2+}, $Pb^{2+}$and Cd^{2+}ions present in a mixture by paper chromatography
- Separation of a mixture of phenylalanine and glycine, alanine and aspartic acid, leucine and glutamic acid by paper and thin layer chromatography
- Separation of drug mixture by TLC

(B) Gravimetric analysis (24 Hours)

(1) Iron as ironoxide
(2) Ni as $Ni(DMG)_2$
(3) Ba as $BaSO_4$
(4) Al as Al_2O_3

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GUJARAT VIDYAPITH: AHMEDABAD

Department of Biogas Research and Microbiology

Faculty of Science and Applied Science, Sadra, Dist: Gandhinagar

B.Sc. Semester IV

DSE 401: Instrumentation and Bio techniques

(Syllabus of theoretical portion) (In force from June 2018)

(Total Marks: 100 (Internal Evaluation: 40 Marks, External evaluation 60 Marks)

Credit: 03+02,

Teaching hours: 45 + Lab hours: 45

Learning Outcomes:

- After studying this paper student get more information about basic knowledge of instruments.
- With the help of above content student can handle/operate the instruments properly.
- Also students get to know the roles of these instruments in various disciplines like Microbiology, Biotechnology, Chemistry etc.
- Using these information students can easily understand the various aspects of characterizations of different samples.

Unit No.	Content	Hours
1	**Microscope:** 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. Electron Microscope: Components of Electron Microscope, Image formation in Electron Microscope, Transmission Electron Microscope (TEM), Scanning Electron Microscope (SEM).	**12**
2	**UV – Visible Absorption Spectroscopy:** Introduction of instrumental methods and its classification. Introduction to UV – Visible Absorption Spectroscopy, Absorption laws Beer's-Lambert's law, its Principle, Applications and limitations. Types of transitions, Instrumentation, Chromophoric effect, auxochromic effect, Bathochromic effect and Hypsochromic effect.	**12**
3	**X-ray Spectroscopy** Generation of X-rays, Instrumentation, diffraction, powder diffraction, single crystal diffractometer	**10**
4	**IR Spectroscopy:** Introduction, Principle, theory, instrumentation, applications and limitations of- Infrared (IR)	**11 hr**

DSE 401: Instrumentation and Bio techniques
(Syllabus of Practical portion)

Sr. No.	Practical	hours
1	Demonstration of spectrophotometer	**5**
2	Sensitivity of thermocouple	**5**
3	Sensitivity of RTD	**5**
4	Sensitivity of thermistor	**5**
5	Characteristic of photo diode	**5**
6	Absorption coefficient	**5**
7	Introduction of SEM (Visit to Instrumentation centre)	**5**
8	Introduction of TEM (Visit to Instrumentation centre)	**5**
9	X-ray diffraction (Visit to Instrumentation centre)	**5**

Basic Text & Reference Books:

- Instrumental Analysis: Douglas A Skoog, F. James Holler and Timothy A. Nieman, Saurabh Printers Pvt. Ltd., 3rd eds. 2009. (ISBN – 13:978-81-315-05427)
- Spectroscopy by Chatwal R. Gurdeep, Himalaya Publishing house
- Biophysical Chemistry (Principles and Techniques) Upadhaya, Upadhaya & Nath, Himalaya Publishing House Pvt. Ltd. 4th eds. 2008.
- Quantitative analysis of pharmaceuticals formulations: Sethi PD (1996), CBS Publishers and Distributors. (ISBN 81-239-0439-8)
- Instrumental Methods of Analysis: Willard, Merritt, Dean and Settle, CBS Publishers & Distributors. (ISBN 81-239-0943-8).
- Instrumental methods of chemical analysis: Chatwal and Anand, Himalaya Publishing House Pvt. Ltd. 5th eds. (ISBN 978-81-8318-802-9)
- Physical Biochemistry Principles and techniques of practical biochemistry and Molecular Biology: Wilson & Walker, Cambridge University Press, Cambridge, 6th eds. 2005. (ISBN 0-521-69180-X).
- Bioanalytical Techniques: Halme and Peck Microscopy and Micro-technique: R. Marimuthu

Science and Applied Science, Sadra, Dist. Gandhinagar
Department of Biogas Research and Microbiology
Semester 4: ENG 401: English
Learning Objectives and Syllabus
(External Evaluation: 60% + Internal Evaluation: 40%)
(Total Teaching Hours: 23, Credit: 1.5)

Learning Objectives:

1. To develop the analytical skill while comprehending texts.
2. To develop scientific vocabulary generally used at the undergraduate levels.
3. To familiarize the students with grammatical category generally used in scientific writing.
4. To develop the scientific writing skills.
5. To familiarize students with different kinds of reading strategies based on the reading needs.

Unit 1: Comprehension and Vocabulary (40%; 10 Hours)

1. A Letter to Indira on her Birthday by Jawaharlal Nehru
2. It Takes a Thief by Arthur Miller

Exercises:

1. Short questions
2. Short descriptive questions
3. Antonyms/Synonyms (Based on the text)
4. Use of Scientific Vocabulary and Phrases

NB: 1. The questions asked will be of informative kind as well as analytical kind where a student has to think through the question keeping in mind the context of the text.
2. Scientific vocabulary and phrases should be taken from what students are using in other papers.

Unit 2: Grammar (10%; 4 Hours)

1. Passive Voice

Unit 3: Writing Skills (30%; 6 Hours)

1. Reporting Events
2. Describing the Process
3. Describing Charts/Pie-charts/Tables***NB: These writing skills should be done keeping in mind grammatical categories of tenses, prepositions, passive voice as well as linking words.***

Unit 4: Academic Skills: Reading Skills (20%; 3 Hours)

1. Extensive Reading
2. Intensive Reading
3. Skimming
4. Scanning
5. SQ3R

NB: Each of the reading techniques is to be demonstrated by relevant reading material made available to the students beforehand.

List of Reference Books:

Nagraj, Dr. Geetha. *Comprehend and Compose.* New Delhi: Foundation Books, 2003.
National Open School. *English: Senior Secondary Course.* Despatch 8. New Delhi: NationalOpen School, 1995.
National Open School. *English: Senior Secondary Course.* Despatch 9. New Delhi: NationalOpen School, 1995.

Rizvi, M. Ashraf. *Effective Technical Communication*. New Delhi: Tata McGraw Hill PublishingCompany Limited, 2005.
Wren, P. C. and H. Martin. *High School English Grammar and Composition*. (Gujarati). Trans.Dr.
Usha Upadhyay and Jegeesha Upadhyay. New Delhi: S. Chand, 2013.**GUJARAT VIDYAPITH: AHMEDABAD**
Faculty of Science and Applied Science, Sadra, Dist. Gandhinagar
Department of Biogas Research and Microbiology
Semester 5: ENG 501: English
Learning Objectives and Syllabus
(External Evaluation: 60% + Internal Evaluation:

GUJARAT VIDYAPITH : AHMEDABAD

Faculty of Science and Applied Sciences, Sadra, Dist: Gandhinagar

Department of Biogas Research and Microbiology

B.Sc. Semester-V

MIC-501 Molecular Genetics of Prokaryotes

(Syllabus of theoretical portion) (In force from June, 2020)

(External Evaluation: 60% + Internal Evaluation: 40%)

(Total Teaching Hours=45, Credit=03)

Objectives and Learning outcomes: Students will have an understanding about the molecular level mechanisms and microbiological processes; shall know about the structure of the prokaryotic genetic material, know the replication and repair mechanisms as well as the organizational variability they present and the relationship between these mechanisms and the cell cycle. They shall be able to describe and identify the structural and functional characteristics of nucleic acids and proteins including their different organisational levels.

They shall develop an understanding about the factors that control gene expression in prokaryotes and relate them to existing environmental conditions and know the different genetic elements existing in prokaryotes, their distribution and the mechanisms of control of gene expression. Describe the genetic basis of the control of gene expression.

The students shall develop a basic understanding about the mutations; their types and consequences; they shall know about the different repair mechanisms present in the prokaryotic systems.

They shall recognize the molecular basis of drug resistance, its origins and the impact they have on infective processes. Understand the biological meaning and applications of genetic transfer mechanisms and genetic elements present in microorganisms.

Overall, the students shall be able to describe the processes of replication, transcription, translation and regulation of genes in prokaryotes; they will be able to develop an understanding about mutations and its consequences and mutagenesis; they shall know about the different types of repairs and know about the horizontal gene transfer mechanisms and recombination.

UNIT 1. Fundamentals **(11 Hours)**

1. Nature of Genetic material **(3 Hours)**

   A. Understanding of terms: Gene, allele, genotype, phenotype, intron, exon, cistron, recon, muton, plasmid, chromosome, genome, zygote, merozygote
   B. Experimental proof for DNA as genetic material: Work of Griffith; Avery, McCarty and MacLeod; Hershey and Chase

2. Gene structure and function **(3 Hours)**

A. Chemistry of DNA, Watson and Cricks model of DNA structure
B. Typical gene structure, functions of gene

3. DNA replication **(5 Hours)**

A. Semi conservative nature, Meselson and Stahl's experiment
B. Molecular mechanism: Strand separation, formation of leading and lagging strand, formation of Okazaki fragments and their removal, proof reading
C. Post-replicative modifications and their significance

UNIT 2. Gene Expression and its Regulation **(11 Hours)**

1. Transcription **(3 Hours)**

A. Initiation, role of enzyme, sigma factor, promoter, operator
B. Elongation
C. Termination: Rho dependent and Rho independent

2. Genetic code: Triplet nature, polarity, degeneracy, near universality and Wobble Phenomenon **(2 Hours)**

3. Translation **(3 Hours)**

A. Initiation, 70 S initiation complex,
B. Elongation: recognition, peptidyl transfer, translocation
C. Termination
D. Fate of ribosomes, polysome system, polycistronic RNA

4. Regulation of gene expression **(3 Hours)**

A. Negative inducible control - lac operon
B. Negative repressible control - trp operon
C. Positive regulation - lac operon

UNIT 3. DNA Damages and their Repair **(12 Hours)**

1. Introduction` **(2 Hours)**

A. Spontaneous and induced mutations, proof for spontaneity of mutation by replica plate method
B. Effect at DNA level, transition, transversion, insertion, deletion, development of A-P Sites

2. Molecular basis of mutation **(2 Hours)**

A. Chemical mutagenesis: 5-bromouracil, nitrous acid and acridine orange
B. Physical mutagenesis: Ultraviolet radiations
C. Biological Mutagenesis: Phage Mu,

3. Consequences of mutation **(4 Hours)**

A. Forward - silent, missense, nonsense, frame shift
B. Reverse – true reversion, suppressions (intragenic and extragenic only)
C. Classes of bacteria mutants; Nutritional, resistant, morphological and conditional mutants

4. Repair mechanisms **(4 Hours)**

   A. Direct repair: Photoreactivation, removal of A-P sites
   B. Indirect repair: Excision repair, mismatch repair
   C. SOS regulatory system

UNIT 4. Gene Transfer among Bacteria (11 Hours)

1. Fundamentals: Horizontal and vertical gene transfer, merozygotic system **(1 Hour)**
2. Transformation: Competence, DNA uptake in Gram positive and Gram negative bacteria, transfection **(2 Hours)**
3. Transduction: Generalized and restricted transduction **(2 Hours)**
4. Conjugation: Role of sex factor, transfer of genes during F + x F-, Hfr x F- and sexduction. **(3 Hours)**
5. Bacterial plasmids and transposable elements **(3 Hours)**
   A. General properties, compatibility groups, maintenance of plasmids
   B. Types of plasmids
   C. Transposable elements: their nature, insertion sequences (IS) and Tn elements

Text Books:

1. Prescott L, Harley J P, and Klein D A, (2008). Microbiology, 7th edn. Wm C. Brown - McGraw Hill, Dubuque, IA.
2. Atlas R M, (1997), Principles of Microbiology. 2nd edn. Wm. C. Brown Pub.,Iowa

Board of Studies (Microbiology)

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GUJARAT VIDYAPITH : AHMEDABAD

Faculty of Science and Applied Sciences, Sadra, Dist: Gandhinagar

Department of Biogas Research and Microbiology

B.Sc. Semester-V

MIC-501 Molecular Genetics of Prokaryotes

(Syllabus of Practical portion) (In force from June, 2020)

(External Evaluation: 60% + Internal Evaluation: 40%)

(Total Teaching Hours=45, Credit=1.5)

Skills: Students will be able to understand the role and structure of DNA; they shall be able to develop protocols for the mutagenesis of microorganisms and relate the structure of nucleic acids with their biological functions.

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1. Isolation of lac- mutants of Escherichia coli using UV radiations as mutagen
2. Isolation of pigmentless mutant of *Serratia marcescens* using UV radiations as mutagen
3. Isolation of streptomycin resistant mutants of Escherichia coli by gradient plate method
4. Isolation of DNA

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GUJARAT VIDYAPITH : AHMEDABAD
Faculty of Science and Applied science, Sadra, Dist: Gandhinagar
Department of Biogas Research and Microbiology
B.Sc. Semester-V

MIC-502 Bacterial Metabolism

(Syllabus of theoretical portion) (In force from June, 2020)
(External Evaluation: 60% + Internal Evaluation: 40%)
(Total Teaching Hours=45, Credit=03)

LEARNING OUTCOMES:

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

- Understand Enzyme kinetics, Importance of enzyme activity and enzyme regulatory mechanisms ,mechanism of energy generation and conservation in bacteria
- Gain knowledge about the enzymes actions in various biochemical pathways of chemo hetero trophs,Basic understanding of basic bio-molecules and their role in metabolism
- Will learn about energy generating metabolic pathway like Pathways of glucose degradation, TCA cycle, β-oxidation ,Catabolism of amino acids
- Will understand Biosynthetic pathways of different molecules like Nitrogen ,Sulfate, saturated and unsaturated fatty acids, and Polymerization of different monomer like aminoacids, fattyacids, Nucleotides,peptidoglycans and methods of studying biosynthesis

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UNIT 1. Enzymes and Energy **(11 Hours)**

1. Enzyme kinetics **(2 Hours)**

   A. Michaelis-Menten equation,
   B. Lineweaver-Burk plot & its significance

2. Metabolic regulation **(3 Hours)**

   A. Significance of metabolic regulation
   B. Types of regulatory mechanisms: Feedback inhibition, energy linked control, precursor activation, zymogen activation, covalent modification and allosterism

3. Energy: its generation & conservation **(6 Hours)**

   A. Laws of thermodynamics, free energy change, redox potential, exothermic and endothermic reactions
   B. Energy rich compounds and their role
   C. Modes of ATP generation
      i. Substrate level phosphorylation
      ii. Role of electron transport chain: Components of electron transport chain in bacteria

iii. Generation of proton motive force and its conversion in to ATP by role of ATP phosphohydrolase, chemiosmosis, inhibitors and uncouplers
iv. Anaerobic respiration and fermentation.

UNIT 2. Chemoheterotrophic Metabolism (11 Hours)

1. Utilizable substrates **(1 Hour)**

2. Catabolism of glucose **(3 Hours)**

A. Pathways of glucose degradation: EMP, ED & PP pathway
B. Fate of pyruvate under aerobic as well as anaerobic conditions

3. Tricarboxylic acid (TCA) cycle **(3 Hours)**

A. Catabolic role of TCA cycle
B. Anabolic role of TCA cycle: Glyoxalate bypass and its significance

4. Catabolism of fatty acids and proteins **(4 Hours)**

A. β-oxidation of fatty acids
B. Catabolism of amino acids: Deamination, decarboxylation, transamination, stickland reaction

UNIT 3. Chemoautotrophic and Phototrophic metabolism (11 Hours)

1. Physiological groups of chemolithotrophs **(2 Hours)**

2. Generation of ATP & reducing power in chemoautotrophs

(forward and reverse etc) **(2 Hours)**

3. Phototrophic metabolism **(7 Hours)**

A. Physiological groups of phototrophs
B. Photosynthetic apparatus in photosynthetic eubacteria, cyclic and noncyclic photophosphorylation
C. Photophosphorylation in halobacteria
D. Pathways for CO_2 fixation
i. Calvin cycle,
ii. Reductive TCA cycle

UNIT 4. Biosynthesis (12 Hours)

1. Principles governing biosynthesis **(3 Hours)**

A. Role of precursor metabolites, ATP, reducing power and their role
B. Anaplerotic reactions and their role in biosynthesis

2. Assimilation of ammonia, nitrate, molecular nitrogen and sulfate **(2 Hours)**

3. Biosynthesis of saturated and unsaturated fatty acids **(2 Hours)**

4. Polymerization of **(3 Hours)**

A. Amino acids into polypeptides
B. Nucleotides into polynucleotide
C. Fatty acids into lipids
D. Biosynthesis of peptidoglycan

5. Methods of studying biosynthesis **(2 Hours)**

Use of biochemical mutants, isotopes, pulse labeling and metabolic inhibitors

Text Books:

1. Stanier R Y, Adelberg E A and Ingrahm J L, (1991), General Microbiology, 5th edn. Mac Millan Press Inc
2. Prescott L, Harley J P, and Klein D A, (2008), Microbiology, 7th edn. Wm C. Brown - McGraw Hill, Dubuque, IA

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GUJARAT VIDYAPITH : AHMEDABAD
Faculty of Science and Applied science, Sadra, Dist: Gandhinagar
Department of Biogas Research and Microbiology
B.Sc. Semester-V

MIC-502 Bacterial Metabolism

(Syllabus of Practical portion) (In force from June, 2020)
(External Evaluation: 60% + Internal Evaluation: 40%)
(Total Teaching Hours=45, Credit=1.5)

LEARNING OUTCOMES:

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

- Get skill of basic techniques like tit ration, pi-petting, calculation, graphic presentation,dilution preparation,Reagent preparation etc.
- Will know about principles and mechanism of estimation techniques of reducing sugar, proteins , antibiotic
- Will know the Standard operating procedure of spectrophotometer

1. Estimation of glucose by Cole's method
2. Estimation of glucose by Nelson-Somogy's method
3. Estimation of protein by Folin-Lawry's method
4. Estimation of streptomycin by sodium nitroprusside method

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GUJARAT VIDYAPITH : AHMEDABAD

Faculty of Science and Applied Sciences, Sadra, Dist: Gandhinagar

Department of Biogas Research and Microbiology

B.Sc. Semester-V

MIC-503 Immunology

(Syllabus oftheoretical portion) (In force from June, 2020)

(External Evaluation: 60% + Internal Evaluation: 40%)

(Total Teaching Hours=45, Credit=3)

Objectives and Learning outcomes: The students will be able to understand about the basic immunological processes; compare and contrast innate and adaptive immunity; understand the roles of different factors responsible for innate immune response; be able to compare and contrast humoral versus cell-mediated immune responses; be able to distinguish various cell types involved in immune responses and associated functions; be able to know the tissues and organs of immune system; be able to distinguish and characterize antibody isotypes, development, and functions; understand the role of cytokines in immunity; and be able to identify and characterize cytokines of particular immune importance; understand the significance of Major Histocompatibility Complex in terms of immune response and transplantation; be able to describe lymphocyte development and the expression of their receptors; and be able to provide an overview of the interaction between the immune system and pathogens; be able to understand the adverse effect of immune system including autoimmunity, hypersensitivity and immunodeficiency; be able to know the basic techniques for identifying antigenantibody interactions; be able to describe the immunological response against tumor. They shall develop a basic understanding about blood, its constituents and blood banking; be able to know about the blood groups, their inheritance and compatibility during blood transfusion; will be able to understand the reasons for immunization, different types of vaccines, vaccination schedules and hazards of vaccines.

UNIT 1. Immunity and Immune response **(11 Hours)**

1. Immunity **(2 Hours)**

A. Concept of innate (native) and acquired (adaptive) immunity
B. Types of immunity
C. Innate immunity: species, racial and individual
D. Acquired immunity: active and passive; natural and artificial
E. Concept of herd immunity

2. Immune response (IR) **(3 Hours)**

A. Concept and basic functions of IR, two arms (branches) of IR: Antibody mediated (humoral) and cell mediated immune (CMI).
B. Characteristics of IR: Discrimination, diversity, specificity, memory and transferability
C. Primary and secondary IR

3. Cells and organs of immune system **(3 Hours)**

A. Lymphocytes as main actors; Types of lymphocytes, B-cells, T-cells and Null cells
B. Importance of antigen presenting cells in IR
C. An introduction to the primary (central) and secondary (peripheral) lymphoid organs

4. Introduction to the advanced concept of immunology **(3 Hours)**

A. MHC and HLA
B. Clonal selection
C. Monoclonal antibodies

UNIT 2. Antigens, Antibodies and their Reaction (11 Hours)

1. Antigens **(3 Hours)**

A. Concept of antigen, immunogen and hapten
B. Physico-chemical and biological properties of antigens
C. Various types of antigens
D. Antigens occurring in bacterial cell

2. Antibodies **(3 Hours)**

A. Concept of antibody, immunoglobulin and myeloma proteins
B. Basic structure of antibodies
C. Classes of immunoglobulins: Physicochemical and biological properties
D. Antibody diversity

1. Antigen-antibody reactions (serological reactions) & other immunological tests **(5 Hours)**

A. Mechanism of antigen-antibody reactions (zone phenomenon); Concept of lattice formation
B. Principles and applications antigen-antibody reactions

i. Precipitin reaction ii. Agglutination reaction
iii. Complement fixation reaction iv. Immunofluorescence
v. Enzyme Linked Immunosorbant Assay (ELISA)
vi. Radio Immunoassay (RIA); Radio-Allergo-Sorbent test (RAST)
vii. Western blot technique

C. Various skin tests
D. Measurement of cell mediated immune response (CMI).

UNIT 3. Immune Disorders (11 Hours)

1. Concept of hyper and hypo functioning of immune system **(3 Hours)**
2. Types immune disorders **(8 Hours)**
   A. Hypersensitivity
   B. Autoimmunity and autoimmune disorders
   C. Immunodeficiency
   D. Tumor immunity
   E. Transplantation immunity, concept of immune suppression

UNIT 4. Immunohaematology and Immunoprophylaxis (12 Hours)

1. Immunohaematology **(6 Hours)**
   A. Concept of immunohaematology: Various blood group antigens and the blood groups
   B. Importance of blood groups in blood transfusion, inheritance & anthropology
   C. A brief introduction to the concept of blood banking
   D. An outline of blood constituents
2. Immunoprophylaxis **(6 Hours)**
   A. Concept of immunoprophylaxis
   B. Types of vaccines
   C. Schedule of vaccination
   D. Hazards of vaccination

Text Books:

1. Atlas R M, (1997), Principles of Microbiology. 2nd edn, Wm. C. Brown Pub., Iowa, USA.
2. Prescott L, Harley J P, and Klein D A, (2008), Microbiology, 7th edn. Wm C. Brown - McGraw Hill, Dubuque, IA.

Board of Studies (Microbiology)

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GUJARAT VIDYAPITH : AHMEDABAD

Faculty of Science and Applied Sciences, Sadra, Dist: Gandhinagar

Department of Biogas Research and Microbiology

B.Sc. Semester-V

MIC-503 Immunology

(Syllabus of Practical portion) (In force from June, 2020)

(External Evaluation: 60% + Internal Evaluation: 40%)

(Total Teaching Hours=45, Credit=1.5)

Skills: Students will be able to understand the basic techniques for studying antigen-antibody interactions (precipitation and agglutinations); they shall develop a basic understanding about blood and its components and blood banking; be able to perform blood grouping, and correlate it with inheritance and compatibility during blood transfusion.

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1. Study of agglutination reaction: Widal test by slide agglutination and double dilution method
2. Demonstration of agar gel immunodiffusion precipitation reaction
3. Determination of human blood group: ABO and Rh systems

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GUJARAT VIDYAPITH : AHMEDABAD
Faculty of Science and Applied science, Sadra, Dist: Gandhinagar
Department of Biogas Research and Microbiology
B.Sc. Semester-V

DSE-501 Bioprocess Technology
(Syllabus of theoretical portion) (In force from June, 2020)
(External Evaluation: 60% + Internal Evaluation: 40%)
(Total Teaching Hours=45, Credit=3)

LEARNING OUTCOMES:

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

- Understand Different terms like bio process, fermentation, industrial microbiology, ferment er, bioreactor etc.,concept of fermentation, historical background of fermentation process,basic components of fermentation process, range of fermentation process
- Have skill of isolation, screening, and improvement of industrially important microorganism , inoculum preparation ,media formulation,sterilization process of media and ferment er
- Have knowledge regarding ferment er design, characteristics, types of different ferment er, control parameters of ferment er scale up and scale down of fermentation process, modes of fermentation process
- Understand what parameters should be ideal for fermentation economics

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UNIT 1. Introduction to Bio process **(11 Hours)**

1. Concept of fermentation and changing phases in industrial microbiology **(2 Hours)**
2. Stages in development of fermentation process (component parts) **(2 Hours)**
3. Range of fermentation processes **(3 Hours)**
4. Screening of industrially important organisms **(4 Hours)**
   A. Characteristics of an industrially ideal organism
   B. Primary screening of amylase, organic acid, antibiotics and amino acid producers
   C. Introduction to secondary screening

UNIT 2. Fermentation media **(11 Hours)**

1. Introduction **(4 Hours)**
   A. Principles of media formulation
   B. Media ingredients: Water, carbon sources, nitrogen sources, minerals, growth factors, buffers, precursors, inducers, inhibitors, antifoam agents
2. Sterilization of media **(3 Hours)**
   A. Use of high-pressure steam: Principle, batch and continuous sterilization process
   B. Use of filtration: Principle, types of filters
1. Inoculum development: General principles for development of seed culture **(4 Hours)**

UNIT 3. Bioreactor Design & Fermentation Economics (11 Hours)

1. Stirred tank Bioreactor **(6 Hours)**
   A. Essential features of a bioreactor (basic functions)
   B. Body construction
   C. Devices for aeration and agitation, pH, temperature, foam and dissolved oxygen
   D. Bioreactor for specialized purposes: Airlift, Tower & Biocatalytic Reactors

2. Design of batch fermenter and continuous fermenter **(3 Hours)**
3. Introduction to fermentation economics **(2 Hours)**

UNIT 4. Modes of Operations & Control parameters (12 Hours)

1. Modes of Operations: Open and closed fermentation, surface culture fermentation, submerged culture (batch, fed-batch & continuous) fermentation, solid substrate fermentation **(6 Hours)**
2. Operating parameters and their control: Aseptic operation, mass transfer of oxygen, foam, pH & temperature **(6 Hours)**

Text Books:

1. Stanbury P F, Whitaker A, and Hall S J, (1995). Principles of Fermentation Technology, 2nd edn, Pergamon Press, London, UK
2. Waites M J, and Morgam N L,(2002). Industrial Microbiology: An Introduction Blackwell Science
3. Crueger W and Crueger A, (2000), Biotechnology: A Text Book of Industrial Microbiology, 2nd edn, Panima Publishing Corporation, New Delhi, India
4. Trevan M D, Boffey S, Goulding K H, and Standury S, (eds), (1987), Biotechnology: The Biological Principles, Tata McGraw-Hill, New Delhi, India.
5. Casida L E, Jr. (1968). Industrial Microbiology, Wiley Eastern Ltd, New Delhi, India

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GUJARAT VIDYAPITH : AHMEDABAD
Faculty of Science and Applied science, Sadra, Dist: Gandhinagar
Department of Biogas Research and Microbiology
B.Sc. Semester-V

DSE-501 Bioprocess Technology
(Syllabus of Practical portion) (In force from June, 2020)
(External Evaluation: 60% + Internal Evaluation: 40%)
(Total Teaching Hours=45, Credit=1.5)

LEARNING OUTCOMES:

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

- Get skill of basic techniques like screening of industrially important microorganism from natural habitats , inoculation procedure under aseptic conditions, dilution preparation, pi-petting, sterilization, media preparation, staining,microscopy , Tit ration etc.
- Will know about which type of organisms in nature have tendency to produce particular product like antibiotics, organic acid, amylase enzyme

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1. Primary screening of amylase producers

2. Primary screening of organic acid producers

3. Primary screening of antibiotic producers by crowded plate method

4. Determination of OTR under static, sparging and shake flask condition by sulfite oxidation method

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GUJARAT VIDYAPITH : AHMEDABAD

Faculty of Science and Applied Sciences, Sadra, Dist: Gandhinagar

Department of Biogas Research and Microbiology

B.Sc. Semester-V

DSE-502 Bio-Safety

(Syllabus of theoretical portion) (In force from June, 2020)

(External Evaluation: 60% + Internal Evaluation: 40%)

(Total Teaching Hours=45, Credit=3)

Objectives and Learning outcomes:The students shall be able to recognize the concept of Biosafety and its Importance in Biological Laboratories; will be able to explain Regulations on Biosafety as per CDC and WHO and also the regulations in our country; understand the means for protecting the laboratory workers from Biological risk factors; know the symbols and warnings used in Laboratory Safety; be able to describe the differences between the Risk groups and the four Biosafety Laboratory Levels; explain the types of risks involved when working in a biological lab; know the means to minimize the potential risks when working in a lab through Biological risk assessment; describe ways or procedures for biological spills; describe the different types of emergencies and also know the emergency response procedures; will be able to know the Responsibility for Safety, Responsibility of the Management and Responsibility of the Employee; will be able to develop an understanding regarding the types of Bio-medical wastes, their sources, hazards of Bio-medical waste and the methodologies for the treatment and disposal of Bio-medical wastes as per the guidelines prescribed by the Government of India.

	UNIT 1	**Introduction to Bio-safety in Clinical Laboratory**	
	Reference: Cheesbrough, 2nd Ed.	**Teaching Duration**	**11 Lectures**
1.1	Implementation of Laboratory Health and Safety Program (**Cheesbrough, 2nd Ed.**)		
1.2	Safe Laboratory Premises and Personal Safety Measures (**Cheesbrough, 2nd Ed.**)		
1.3	Importance of CDC and NIH		
1.4	Universal Precautions for Laboratories by CDC		
1.5	Special Precautions Against HBV and HIV		
	UNIT 2	**SAFE METHODS FOR MANAGING INFECTIOUS AGENTS IN LABORATORY ENVIRONMENT**	
	Reference: WHO 3Ed./Kolhatkar	**Teaching Duration**	**11 Lectures**
2.1	Safety Precaution Against Infection		
2.2	Containment		
2.3	Bio-safety Levels		
2.4	Bio-safety Levels of Infectious Agents Recommended by CDC		
2.5	Biological Safety Cabinets		
	UNIT 3	**BIO-SAFETY PROGRAM**	
	Reference: Cheesbrough, 2nd Ed.	**Teaching Duration**	11 **Lectures**

3.1	Responsibility for Safety		
3.2	Responsibility of the Management		
3.3	Responsibility of the Employee		
	UNIT 4	**DISPOSAL OF MEDICAL WASTE**	
	Reference: Singh & Kaur, 1st Ed.	**Teaching Duration**	12 **Lectures**
4.1	Types of Bio-medical Waste		
4.2	Major and Minor Sources of Bio-medical Waste		
4.3	Hazards of Bio-medical Waste		
4.4	Need for Disposal of Bio-medical Waste		
4.5	Treatment and Disposal of Bio-medical Waste		

REFERENCES:

- Ochei & Kolhatkar, (2000), *Medical Laboratory Science- Theory and Practice*, Tata McGraw-Hill Publishing Company Ltd., ISBN: 9780074632239
- Monica Cheesbrough (2006), *District Laboratory Practice in Tropical Countries Part 1 & 2*. 2nd Ed., Cambridge University Press, ISBN No. 9780521665469
- Anantpreet Singh & Sukhjit Kaur (2012), *Biomedical Waste Disposal, JayPee Publication*, 1st Ed., ISBN No. 9789350255544
- WHO, (2004), *Laboratory safety Manual*, 3rd Ed., World Health Organization, ISBN 9789241544504

Further reading :

- Sood R., (2015), *Concise Book of Medical Laboratory: Technology Methods & Interpretations*, Jaypee Brothers, ISBN: 9789351523338

Board of Studies (Microbiology)

(1)	Dr. Nikhil S. Bhatt	(6)	Dr. Srinivas Duggirala
(2)	Dr. S. R. Dave	(7)	Dr. Niraj Sheth
(3)	Dr. Devyani Tipre	(8)	Mrs. Priti Shukla
(4)	Dr. Rakesh Patel	(9)	Mr. Arvind Dungrechiya
(5)	Dr. Nupur Goyal	(10)	Dr. Nishant Junnarkar

GUJARAT VIDYAPITH : AHMEDABAD

Faculty of Science and Applied Sciences, Sadra, Dist: Gandhinagar

Department of Biogas Research and Microbiology

B.Sc. Semester-V

DSE-502 Bio-Safety

(Syllabus of Practical portion) (In force from June, 2020)

(External Evaluation: 60% + Internal Evaluation: 40%)

(Total Teaching Hours=45, Credit=1.5)

Skills: The students shall be able to recognize, design and implement biosafety guidelines in the laboratories; they shall deveolp an understanding about the means of protecting laboratory personnel during the laboratory experiments; they shall be able to know the symbols and warnings used in the laboratory; they shall be able to identify the types of risks involoved in the laboratory; they shall be abkle to identify the emergencies and the line of action to be followed in emergencies; they shall develop the skill of sorting the laboratory waste, their transport and disposal techniques; they shall develop the skill to deal with biological spills and their cleaning and disinfection procedure; they shall develop the understanding about the different biosafety level laboratories and the ethics to be observed therein.

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1) Maintaining Safe Laboratory Premises and Personal Safety Measures.
2) Maintaining the laboratory requirements and monitoring maintenance of the laboratory equipments and their standardizations.
3) Using proper safety symbols in the laboratory.
4) Safety Precautions while handling the microorganisms.
5) Managing the proper sorting, disinfection and disposal of laboratory wastes.

Board of Studies (Microbiology)

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GUJARAT VIDYAPITH : AHMEDABAD
Faculty of Science and Applied Science, Sadra, Dist: Gandhinagar
Department of Biogas Research and Microbiology
B.Sc. Semester-V
DSE-501 Microbiology Laboratory Hazards And Precautions
(Syllabus of theoretical portion) (In force from December, 2019)
(External Evaluation: 60% + Internal Evaluation: 40%)
(Total Teaching Hours=45, Credit=03)

Learning outcomes

- The ability to define the terms hazard and risk including the relevance of routes of exposure in a laboratory.
- The ability to conduct risk assessments for biological risks, and environmental assessments which include consideration of people at risk.
- The ability to evaluate risk assessments for work involving biological agents including with materials which may contain them, and consequences for risk assessment of techniques involving propagation or concentration
- A thorough knowledge of the basis for hazard categorization of biological agents and implications for containment.
- A thorough knowledge of both physical and managerial control measures including PPE, aerosol minimisation and containment, percutaneous injuries etc applying the hierarchy of control. Hazards and risks
- A thorough knowledge of applications of the different classes of microbiological safety cabinets . A thorough knowledge of the biosafety issues relating to typical laboratory equipment.

MICROBIOLOGY LABORATORY HAZARDS AND PRECAUTIONS

UNIT 1 LABORATORY HAZARDS AND PRECAUTIONS (07 hrs)

1.1Common Hazards in Laboratory

1.Unsafe premises 2. Equipment hazards 3. Naked flames 4.Explosions
5. Microbial hazards 6. Infestation by ants,rodents, cockroaches
7.Chemical hazards 8. Glassware hazards 9. Unreliable water supply
10. Sharps hazards

1.1.1Safe laboratory premise and personal safety measures

1.2Microbial Hazards (Cheesbrough, 2nd Ed.)

1.Laboratory acquired infections
2.Classification of infective microorganisms

1.3Hazard Warning Symbols
1.4Laboratory First Aid
First Aid equipment ,Recommended contents of a laboratory First Aid box
1.Emergency first aid procedures 2.Emergency treatment of cuts and bleeding 3.Emergency resuscitation when a person stops breathing (Mouth-to-mouth respiration (ventilation), Heart not beating) 4.Emergency treatment when someone faints 5.Emergency treatment when someone is electrocuted 6.Emergency treatment of heat and chemical burns 7.Emergency treatment for poisoning

UNIT 2 EQUIPMENT RELATED HAZARDS (07 hrs)
2.1Equipment and their Operation Borne Hazards
2.2Equipment and Glassware Related Hazards
2.3Equipment Designed to Eliminate or Reduce Hazards

UNIT 3 HAZARDOUS CHEMICALS IN LABORATORY, FIRE AND ELECTRICAL HAZARDS (08 hrs)
3.1 **Various Dangerous Chemicals**
- 3.1.1 **Flammable Chemicals**(Classification of flammable chemicals, Safe storage and use of flammable chemicals, Control of fires involving flammable liquids)
- 3.1.2 **Corrosive Chemicals**(Safe storage and use)
- 3.1.3 **Toxic and Irritative Chemicals**(Safe storage and use of toxic, harmful and irritating chemicals,Injuries caused by mouth-pipetting chemicals and reagents,Accidents involving toxic, harmful, and irritating chemicals
- 3.1.4 **Carcinogenic Chemicals**
- 3.1.5 **Explosive Chemicals** (Environmentally dangerous chemicals,spillage control guidelines)
- 3.1.6 **Radioactive Chemicals**
- 3.1.7 I**ncompatible Chemicals**(Acid–Base Incompatibles,Strong Oxidants and Reductants,Chemicals That React With Water——Water-Reactives, Pyrophorics——Incompatibles with Air, Storingand working with Incompatible Chemicals).

3.2 **Toxic Effect of Chemicals**
3.3 **Compressed and Liquefied Gases** (Safety guidelines for compressed and liquified gases)
3.4 **Fire in Laboratory, Cause and Extinguishers**(Classes of Fires,Types of Fire Extinguishers
3.5 **Electrical Hazards**(Hazards from Electrical Contact,Preventing Electrical Shock,Using Electrical Equipment,Avoiding Electrical Contact in the Lab)

UNIT 4 SAFE LABORATORY TECHNIQUES (08 hrs)
4.1**Various Safe Techniques Used in Laboratory**
4.1.1 **Technique for Pipettes and Pipetting Aids**
4.1.2 **Technique for Avoiding The Dispersal Of Infectious Material**
4.1.3 **Technique for the Use of Biological Safety Cabinets**
4.1.4 **Technique for Avoiding Ingestion of Infectious Material and Their Contact with Skin and Eyes**
4.1.5 **Technique for Avoiding Infectious Material**

4.1.6 **Technique for Separation Of Serum**
4.2 **Safe Technique for the use of Instruments , Organisms and Materials (Use of centrifuges,Use of homogenizers, shakers, blenders and sonicators, Use of tissue grinders,Care and use of refrigerators and freezers**
4.3**Safe Technique for Opening and Storage of Ampoules**
4.4**Special Precautions with Blood and Body Fluids**

REFERENCES:

1.WHO, (2004), *Laboratory safety Manual*, 3nd Ed., World Health Organization, ISBN 9789241544504
2.Ochei & Kolhatkar, (2000), *Medical Laboratory Science- Theory and Practice*, Tata McGraw-Hill Publishing Company Ltd., ISBN: 9780074632239
*3.*Monica Cheesbrough, (2006), *District Laboratory Practice in Tropical Countries Pa1& 2*. 2nd Ed., CambridgUniversity Press, ISBN No. 9780521665469

Further reading :

4.Sood R., (2006), *Textbook of Medical Laboratory Technology*, Jaypee Brothers, ISBN: 9788180615917
5.P.B.Godkar,(2014)Textbook of Medical Laboratory Technology, 3rd edition, Bhalani Publishers.

GUJARAT VIDYAPITH : AHMEDABAD
Faculty of Science and Applied Science, Sadra, Dist: Gandhinagar
Department of Biogas Research and Microbiology
B.Sc. Semester-V
DSE-501 Microbiology Laboratory Hazards And Precautions
(Syllabus of Practical portion) (In force from December, 2019)
(External Evaluation: 60% + Internal Evaluation: 40%)
(Total Teaching Hours=45, Credit=1.5)

Learning outcomes

- The ability to define the terms hazard and risk including the relevance of routes of exposure in a laboratory.
- The ability to conduct risk assessments for biological risks, and environmental assessments which include consideration of people at risk.
- Students will get an hand on practice on the use of fire extinguishers

1.Introduction to Common Hazards in microbiology Laboratory
2.Safe laboratory premise and personal safety measures
3.An understanding to Hazard Warning Symbols
4. Safe use of Hazardous Chemicals in Laboratory
5.A visit to a fire station
6.Introduction to Safe Laboratory Techniques

GUJARAT VIDYAPITH: AHMEDABAD
Faculty of Science and Applied Science, Sadra, Dist. Gandhinagar
Department of Biogas Research and Microbiology
Semester 5: ENG 501: English
Learning Objectives and Syllabus
(External Evaluation: 60% + Internal Evaluation: 40%)
(Total Teaching Hours: 30, Credit: 2)

Learning Objectives:

1. To appreciate literary writing and understand components of literary writings.
2. To develop skills of finding meaning from the context.
3. To develop the skill of oral presentation in formal setting.
4. To develop the skill of group discussion.
5. To develop the skill of different kinds of written business communications.
6. To develop the skill of writing project proposals.
7. To develop academic skills.

Unit 1: Comprehension and Vocabulary(30%:09Hours)

1. Sparrow by K. A. Abbas
2. The Model millionaire by Oscar Wilde
3. The Last Leaf by O. Henry

Exercises:

1. Short questions
2. Short notes
3. Antonyms/Synonyms
4. Guessing meaning from the context (Inferences)

Unit 2: Speaking Skills (20%: 06Hours)

1. Delivering a Presentation
2. Group Discussion

Unit 3: Writing Skills (40%: 12 Hours)

1. Drafting Invitations –Formal and Informal
2. Preparing Travel Itinerary
3. Preparing Print Advertisements / Handbills4. Designing a Brochure
5. Writing Project Reports

Unit 5: Academic Skills (10%; 03 Hours)

1. Preparing Bibliography
2. Rules of Citation
3. Concept of Plagiarism

List of Reference Books:

Rizvi, M. Ashraf. *Effective Technical Communication.* New Delhi: Tata McGraw Hill PublishingCompany Limited, 2005.
Tickoo, M. L. et al. Eds. *Stories, Plays and Tales of Adventure.* New Delhi: NCERT, 1996.

GUJARAT VIDYAPITH : AHMEDABAD
Faculty of Science and Applied Science, Sadra, Dist: Gandhinagar
Department of Biogas Research and Microbiology
B.Sc. Semester-VI
MIC-601 Genetic Engineering and Biotechnology
(Syllabus of theoretical portion) (In force from December, 2020)
(External Evaluation: 60% + Internal Evaluation: 40%)
(Total Teaching Hours=45, Credit=03)

Learning outcomes

- Enabling the students to know and understand the basics, techniques and the applications of Molecular Cloning.
- Acquiring knowledge on PCR, DNA sequencing and Mutations and Mutagenesis.
- Understanding the Applications and Scope of Genetic Engineering.
- Understanding the concepts of Regulatory aspects.
- Students will understand gene transfer technologies for animals and animal cell lines.
- Students will understand the ethical issues and potential of biotechnology for the benefit of man kind.

UNIT 1. Fundamentals (11 Hours)

1. Introduction **(1 Hour)**
2. Tools **(6 Hours)**

A. Enzymes: Restriction endonuclease, reverse transcriptase, terminal transferase,alkaline phosphatase, ligases.

B. Vectors: Definition, criteria for selection of DNA vectors, Types of vectors: plasmid vector (pBR 322), phage vector (λ), cosmid, shuttle vector-YEP & Ti plasmid

C. Genetic probes Oligonucleotides

3. Site directed mutagenesis **(02 Hours)**
4. Polymerase chain reaction **(2 Hours)**

UNIT 2. Construction of rDNA and its Transfer to Host Cell (11 Hours)

1. Obtaining desired DNA fragment- Isolation from host, cDNA preparation and DNA synthesis. **(2 Hours)**
2. Protocol for joining isolated DNA with vector. **(1 Hour)**
3. Transfer of rDNA in to suitable host cell- transfection, gene gun, microinjection,protoplast fusion and electroporation. **(4 Hours)**
4. Selection of recombinant population: Use of marker genes and X- gal dye, colony hybridization, Gene probe: Southern blot & Western blot technique **(4 Hours)**

UNIT 3. Biotechnology and Techniques Employed (11 Hours)

1. Introduction to biotechnology **(1 Hour)**
2. Tissue culture: Plant and animal tissue culture **(3 Hours)**
3. Analytical methods: Chromatography, electrophoresis, spectroscopy, molecular hybridization, DNA microarrays, ELISA, RIA, RAST **(7 Hours)**

UNIT 4. Areas of Application of Biotechnology (12 Hours)

1. Agricultural biotechnology: Biofertilizers, bioinsecticides, genetically modified/transgenic plants **(3 Hours)**
2. Enzyme biotechnology: Analytical, industrial and therapeutic applications **(2 Hours)**
3. Environmental biotechnology: Bioremediation, biofuels and bioleaching, MEOR **(3 Hours)**
4. Intellectual property rights and biotechnology **(2 Hours)**
5. Ethical issues of biotechnology. **(2 Hours)**

Text Books:

1. Trevan M D, Boffey S, Goulding K H and Standury S, (eds), (1987). Biotechnology:The Biological Principles,Tata McGraw-Hill, New Delhi. India
2. Prescott L, Harley J P and Klein D A, (2008), Microbiology, 7th edn. Wm C. Brown -McGraw Hill, Dubuque, IA
3. Atlas R M, (1997), Principles of Microbiology. 2nd edn., Wm. C. Brown Pub, Iowa, USA.

Board of Studies (Microbiology)

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GUJARAT VIDYAPITH : AHMEDABAD
Faculty of Science and Applied science, Sadra, Dist: Gandhinagar
Department of Biogas Research and Microbiology
B.Sc. Semester-VI
MIC-601 Genetic Engineering and Biotechnology
(Syllabus of Practical portion) (In force from December 2020)
(External Evaluation: 60% + Internal Evaluation: 40%)
(Total Teaching Hours=45, Credit=1.5)

Learning Outcomes

- Develop ability to design and conduct genetic engineering experiment.
- Obtain knowledge and understanding of applications of these techniques.

1. Separation of amino acids by paper chromatography
2. Separation of amino acids by thin layer chromatography
3. Demonstration of separation of components of India ink by paper electrophoresis
4. Immobilization of cells by calcium-alginate entrapment method and demonstration of activity by methylene blue reduction test
5. Isolation of DNA from *Escherichia coli*
6. Estimation of DNA by Diphenylamine method
7. Demonstration of Conjugation in *E.coli*
8. Demonstration of transformation

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GUJARAT VIDYAPITH : AHMEDABAD
Faculty of Science and Applied science, Sadra, Dist: Gandhinagar
Department of Biogas Research and Microbiology
B.Sc. Semester-VI
MIC-602 Virology and Mycology
(Syllabus of theoretical portion) (In force from December 2020)
(External Evaluation: 60% + Internal Evaluation: 40%)
(Total Teaching Hours=45, Credit=3)

Learning outcomes

- Students will gain knowledge about the basic concepts of virology. including their the structure, classification ,Cultivation of viruses: and life cycle of viruses.
- Students will learn about the introduction and replication of Plant and Animal viruses.
- Students will gain knowledge about the basic concepts of Mycology, their nutrition and nutrient requirements of fungi.
- Students will get familiar about the diseases caused by fungi in plants and animals.
- Students will obtain knowledge about the characteristics of the major classes and orders within the fungal kingdom.
- Students will learn about how fungi grow and reproduce, and where and how they can be isolated.

UNIT 1. Viruses: General **(11 Hours)**

1. General characteristics and structural organization of virus **(1 Hour)**
2. Cultivation of viruses: **(4 Hours)**

A. Animal cultivation
B. Cultivation in embryonated eggs,
C. In vitro culture: Cell Lines, primary and secondary cell lines, continuous cell lines,cytopathic effects
D. Cultivation of bacteriophages

3. Enumeration (assay) of viruses: Methods of enumeration of viruses **(1 Hour)**
4. Classification of viruses: PCNV, ICNV and Cryptogram system of viral classification **(2 Hours)**
5. Sub-viral entities: Viroids, virusoids, prions, introduction to persistent, latent and slow viruses, oncogenic viruses **(3 Hours)**

UNIT 2. Bacterial / Plant / Animal Viruses (11 Hours)

1. Bacteriophage lytic cycle (T4 Phage) **(3 Hours)**

A. One step growth curve experiment, burst size

B. Phage adsorption and penetration, intracellular development, early and late events,replication of phage chromosome, phage morphogenesis and release

C. Host induced modifications

D. Introduction to single stranded DNA and RNA phages ØX174 and MS2

2. Bacteriophage lysogenic cycle (lambda phage): Mechanism of establishment of lysogeny, induction of lysogeny, phage-conversion, replication of lambda phage **(3 Hours)**

3. Plant Viruses: Introduction and replication of plant viruses (TMV) **(2 Hours)**

4. Animal viruses **(3 Hours)**

A. Introduction and replication (adsorption, penetration, uncoating, replication, synthesis and assembly, and release) of animal viruses in general (HIV)

B. Consequences of viral infection

C. Persistent infection, latent infection, transformation and viral interference

UNIT 3. Fungi: General (11 Hours)

1. General characters: Somatic structure, ultra-structure of fungal cell, hyphal modification **(3 Hours)**

2. Cultivation of fungi: **(3 Hours)**

A. Principles of fungal nutrition

B. Cultivation media and methods, slide culture technique, prevention of bacterial contamination

C. Preservation of fungi

3. Importance of fungi: **(5 Hours)**

A. Primary and secondary metabolites of fungi and its importance,

B. Diseases caused by fungi in plants and animals

UNIT 4. Fungi: Reproduction and Classification (12 Hours)

1. Reproduction in fungi: Asexual and sexual methods of reproduction, parasexuality among fungi, fruiting bodies in fungi **(3 Hours)**

2. Fungal classification: Criteria used for classification, recent classification system, **(2 Hours)**

3. Brief outline of different classes of fungi: (Structure, habitat, reproduction/life cycle and economic importance in general) **(7 Hours)**

A. Phycomycetes (Phycomycotina)

B. Ascomycetes (Ascomycotina)

C. Basidiomycetes (Basiomycotina)
D. Deutromycetes (Duteromycotina)
E. Slime molds

Text Books:

1. Alexopoulos C J, Mims C W, Blackwell M, (1996), Introductory Mycology, 4th ed.,Blackwell Publishing
2. Sharma O P, (1989), Textbook of Fungi, Tata McGraw-Hill Publishing Co. Ltd
3. Dube H C, (1990), An Introduction to Fungi, 2nd edn, Vikas Publishing House Pvt Ltd
4. Biswas S B, Biswas A, An Introduction to Viruses, 3rd ed., (1984), Vani Educational Books, New Delhi
5. Atlas R M, (1997), Principles of Microbiology. 2nd edn., Wm. C. Brown Pub., Iowa, USA.
6. Prescott L, Harley J P, and Klein D A, (2008), Microbiology, 7th edn. Wm C. Brown- McGraw Hill, Dubuque, IA

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GUJARAT VIDYAPITH : AHMEDABAD
Faculty of Science and Applied science, Sadra, Dist: Gandhinagar
Department of Biogas Research and Microbiology
B.Sc. Semester-VI
MIC-602 Virology and Mycology
(Syllabus of Practical portion) (In force from December 2020)
(External Evaluation: 60% + Internal Evaluation: 40%)
(Total Teaching Hours=45, Credit=1.5)

Learning Outcomes

- Students will get a practical exposure how to isolatie bacteriophage from sewage
- Students will get a practical exposure to Cultivation of and microscopic examination of fungi
- Students will get knowledge about various plant diseases caused by Virus and Fungi

1. Isolation of bacteriophage from sewage
2. Isolation and cultivation of yeasts
3. Cultivation of and microscopic examination of molds by slide culture technique
4. Cultivation and microscopic examination of molds—*Neurospora, Fusarium, Alternaria, Curvularia* and *Helminthosporium*
5. Study of plant diseases caused by Virus and Fungi—Mosaic, red rot, rust, smut, wilt,leaf curl, powdery mildew, downy mildew

Board of Studies (Microbiology)

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GUJARAT VIDYAPITH : AHMEDABAD

Faculty of Science and Applied science, Sadra, Dist: Gandhinagar

Department of Biogas Research and Microbiology

B.Sc. Semester-VI

MIC-603 Medical Microbiology

(Syllabus of theoretical portion) (In force from December 2020)

(External Evaluation: 60% + Internal Evaluation: 40%)

(Total Teaching Hours=45, Credit=3)

Objectives and Learning outcomes:

The student shall develop an understanding about the host- parasite interactions; the process of infection and the factors affecting these processes; they shall understand the virulence factors of pathogenic organisms; they shall understand the non-specific host defences and their role in protecting the body against infection.

They shall be able to know the and the role of the human body's normal microflora, its establishment and role. Students will understand the concept of epidemiology, alonwith the techniques and markers used for the study of disease occurence and spread.

Students will be able to identify common infectious agents and the airborne, food-waterborne, direct contact, arthropod borne and zoonoses diseases that they cause.

Students shall gain the knowledge about the collection and processing of different clinical specimen and will be able to evaluate methods used to identify infectious agents in the clinical microbiology lab. The student will be able to recognize and diagnose common infectious diseases from the clinical specimen. The student will be able to assess treatment strategies including the appropriate use of antimicrobial agents and common mechanisms of antimicrobial action and resistance. The student will be able to explain means employed to prevent infectious diseases including infection control measure and vaccines.

UNIT 1. Host-Parasite Relationship **(11 Hours)**

1. Concept of host- parasite Relationship **(2 Hours)**

2. Microbial pathogenicity **(5 Hours)**

   A. Overview of bacterial and viral pathogenicity
   B. Factors affecting the process of infection
   C. Pathogenicity
      i. Invasiveness: Role of structures and secretions of bacteria
      ii. Toxigenicity: Protein and LPS toxins; their properties and mode of action

3. Non-specific host defenses **(4 Hours)**

   A. First line of (primary) defense: Physical and mechanical defense; role of skin and mucus membrane

B. Second line of (secondary) defense: cellular and chemical; defenses

UNIT 2. Microbiota of Human Body and Epidemiology (11 Hours)

1. Normal microbiota of human body **(4 Hours)**

A. Importance, origin and establishment
B. Microbiota of various body parts
C. Gnotobiotic life and gnotobiosis

2. Epidemiology of infectious disease **(7 Hours)**

A. Concept of Epidemiology
B. Epidemiological types of infections
C. Techniques used to study epidemiology
D. Epidemiological markers
E. Disease cycle
F. Nosocomial infections: sources, transmission and their control

UNIT 3. Microbial Diseases of Human Being (11 Hours)

1. Airborne infections: Tuberculosis, influenza **(2 Hours)**
2. Food and waterborne infections: Typhoid fever, food poisoning, hepatitis **(2 Hours)**
3. Contagious diseases: Syphilis, AIDS **(2Hours)**
4. Arthropod borne diseases: Plague, yellow fever, malaria **(2Hours)**
5. Zoonoses: Rabies, anthrax **(1 Hour)**

UNIT 4. Clinical Microbiology (12 Hours)

1. Specimen: Types of specimen, method of collection, storage and transport**(6 Hours)**

2. Methods used for diagnosis and identification of pathogen **(6 Hours)**

A. Microscopy
B. Growth and biochemical characteristics
C. Clinical immunology
D. Pathological changes in blood, body fluids and tissues
E. Significance of computer and possible use of biosensors

Text Books:

1. Prescott L, Harley J P, and Klein D A, (2008), Microbiology, 7th edn. Wm C. Brown - McGraw Hill, Dubuque, IA.
2. Baker F J, Silverton R E, Pallister C J, (1998), Baker and Silverton's Introduction to Medical Laboratory Technology, 7th edn, Butterworths-Heinemann, Oxford, UK
3. Tortora G J, Funke B R, Case C L, (2008), Microbiology: An Introduction, 8th edn, Benjamin Cummings

Board of Studies (Microbiology)

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GUJARAT VIDYAPITH : AHMEDABAD

Faculty of Science and Applied Sciences, Sadra, Dist: Gandhinagar

Department of Biogas Research and Microbiology

B.Sc. Semester-VI

MIC-603 Medical Microbiology

(Syllabus of Practical portion) (In force from December 2020)

(External Evaluation: 60% + Internal Evaluation: 40%)

(Total Teaching Hours=45, Credit=1.5)

Skills: The students will develop the skill of isolating, characterizing and identifying the causative agent of the disease from the clinical specimen using biochemical media, rapid identification kits and microscopy. The student shall develop an understanding about the detection techniques for estimating blood sugar and blood urea. They shall be able to carry out the routine and microsopic examination of urine. They students will be able to identify the different vectors and the causative agents of the disease from permanent slides.

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1. Isolation, cultivation and identification of gram-negative bacteria— *Escherichia coli, Enterobacter aerogenes, Proteus vulgaris, Pseudomonas aeruginosa, Salmonella typhi, Salmonella paratyphi A, Salmonella paratyphi B*
2. Demonstration of characterization of Gram-negative bacteria based on biochemical reactions using rapid identification kit
3. Study of antibiogram (using multidisk)
4. Physical and chemical analysis of urine
5. Estimation of blood urea by diacetyl monoxime method (DAM)
6. Study of permanent slides
   A. Insect vectors: Female anopheles mosquito, head louse, tick, flea, mite.
   B. Microorganisms: Actinomycetes, yeast, bacteroids, acid-fast bacilli, spirochetes, *Streptococcus pneumoniae*, *Clostridium tetani* and *Plasmodium vivax*

Board of Studies

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GUJARAT VIDYAPITH : AHMEDABAD
Faculty of Science and Applied science, Sadra, Dist: Gandhinagar
Department of Biogas Research and Microbiology
B.Sc. Semester-VI

DSE-601Fermentation Technology

(Syllabus of theoretical portion) (In force from December 2020)
(External Evaluation: 60% + Internal Evaluation: 40%)
(Total Teaching Hours=45, Credit=3)

LEARNING OUTCOMES:

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

- Understand Different strain improvement strategies, importance of strain improvement,Preservation of industrial important microorganisms
- Will aware about different problems of downstream processes , designing of downstream process,separation techniques cell disruption techniques,product concentration techniques and purification of product from impurities
- Will get skills of quality of product like bio-assay, sterility, pyrogen testing also get knowledge regarding importance of clean room environment,environment safety procedures ,effluent treatment process
- Have knowledge regarding industrial production of differ net products like penicillin, amylase, citric acid, lysine, vitamin B12, Ethanol etc.

UNIT 1. Strain Improvement **(11 Hours)**

1.Introduction **(1 Hour)**

2. Strategies of strain improvement **(4Hours)**

A. Selection and adaptation
B. Selection of induced mutants
C. Selection of recombinants

3. Strain improvement for modification of properties other than yield **(4Hours)**

4. Preservation of industrially important organism: Principle, methods and quality control **(2Hours)**

UNIT 2. Downstream Processing **(11 Hours)**

1. Introduction to downstream processes: Problems and designing **(1 Hour)**

2. Removal of microbial cells and suspended solids **(3 Hours)**

A. Foam separation
B. Precipitation
C. Filtration
D. Centrifugation

3. Cell disruption methods **(2 Hours)**

A. Introduction
B. Physico-mechanical methods
C. Chemical methods

4. Product concentration and purification **(4 Hours)**

A. Liquid-liquid extraction
B. Chromatography
C. Membrane processes

5. Finishing stages **(1 Hour)**

A. Drying
B. Crystallization

UNIT 3. Quality Assurance and Safety Measurement (11 Hours)

1. Quality assurance of products **(5Hours)**

A. Bioassay
B. Sterility testing
C. Pyrogen testing

2. Manufacturing and environment safety **(5 Hours)**

A. Containment
B. Clean room environment
C. Effluent treatment

3. Introduction to scale-up **(1 Hour)**

UNIT 4. Typical Fermentation Processes (12 Hours)

1. Penicillin fermentation **(2 Hours)**

2. Citric acid fermentation **(2 Hours)**

3. Ethanol fermentation **(2Hours)**

4. Vitamin B12 fermentation **(2Hours)**

5. Lysine fermentation **(2 Hours)**

6. Amylase fermentation **(2 Hours)**

Text Books:

1. Stanbury P F, Whitaker A and Hall S J, (1995), Principles of Fermentation Technology, 2nd edn, Pergamon Press, London, UK
2. Waites, M J and Morgam N L, (2002), Industrial Microbiology: An Introduction, Blackwell Science
3. Crueger W and Crueger A, (2000), Biotechnology: A Text Book of Industrial Microbiology, 2nd edn, Panima Publishing Corporation, New Delhi, India
4. El-Mansi E M T, Bryce C F A, Dahhou B, Sanchez S, Demain A L, Allman A R (eds), (2011), Fermentation Microbiology and Biotechnology, 3rd edn, CRC Press; Taylor and Francis Group, Boca Raton
5. Casida L E, Jr. (1968). Industrial Microbiology, Wiley Eastern Ltd, New Delhi, India

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GUJARAT VIDYAPITH : AHMEDABAD
Faculty of Science and Applied science, Sadra, Dist: Gandhinagar
Department of Biogas Research and Microbiology
B.Sc. Semester-VI

DSE-601Fermentation Technology

(Syllabus of Practical portion) (In force from December 2020)
(External Evaluation: 60% + Internal Evaluation: 40%)
(Total Teaching Hours=45, Credit=1.5)

LEARNING OUTCOMES:

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

- Get skill of basic techniques like Media formulation, sterilization process, aseptic operation ,inoculation, assaying techniques, pipetting, Bioassay , sterility check procedure in pharmaceutical industry.

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1. Fermentative production of amylase and its activity check
2. Demonstration of recovery of crude protein / amylase from fermentation broth either by salting out (ammonium sulfate) or by using isopropyl alcohol
3. Bioassay of penicillin using *Bacillus subtilis*
4. Sterility testing of pharmaceutical product

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B. Sc. Semester-VI

DSE-602 QUALITY ASSURANCE IN MICROBIOLOGY

(Syllabus of theoretical portion) (In force from December 2020)
(External Evaluation: 60% + Internal Evaluation: 40%)
(Total Teaching Hours=45, Credit=3)

Learning Outcomes

- Recognize importance of biosafety practices and guidelines in Microbiology
- List important safety rules,Comply with and perform the correct safety procedures during lab.
- Become aware of the principles of safety, quality assurance and quality control in Serology.
- Significance of Accreditation process
- Acquire a knowledge and understanding of microbiological assays

UNIT 1 BIOSAFETY GUIDELINES **(11 Hours)**

1.Microbiological Risk Assessments **(1Hour)**

2.Biosafty level 1 and 2 **(3 Hours)**

2.1 Code of practice
2.2 Laboratory design facilities
2.3 Laboratory equipment
2.4 Health and medical surveillance
2.5 Training and waste handling
2.6 Chemical, fire, electrical, radiation and equipment safety

3. Biosafty level 3 and 4 **(3Hours)**

Code of practice
Laboratory design facilities
Laboratory equipment
Health and medical surveillance

4. Laoratory biosecurity concept **(2Hours)**

5 Biological safety cabinet **(2 Hours)**

UNIT 2 QUALITY ASSURANCE IN MICROBIOLOGY AND SEROLOGY **(11 Hours)**

(Tambwekar)

2.1.Introduction **(2Hours)**

2.2 Stages of quality Assurance **(6 Hours)**

A.Pre analytical stage
B. Analytical stage
C.Post analytical stage

2.3 QC in serology **(3Hours)**

UNIT 3 THE ACCREDITATION PROCESS **(Hewitt)** **(11 Hours)**

3.1.Benefits of Accreditation **(2 Hours)**

3.2 Criteria for Accreditation **(2Hours)**

3.3Audit **(2 Hours)**
3.4 Process of Accreditation **(2Hours)**
3.5 List of Accreditation agency **(3Hours)**
UNIT 4 MICROBIOLOGICAL ASSAY **(12 Hours)**
4.1.Standard reference materials **(6Hours)**
A.Official Reference Materials
B.National and regional reference materials
C.Inhouse standards
4.2 Microbiological Assay **(6Hours)**
A.Inoculum
B.Test solutions
C.Assay medium
D.Aseptic techniques
E.Measurement of response

REFERENCES:

- William Hewitt (2003), *Microbiological Assay for Pharmaceutical Analysis: A Rational Approach*. CRC Press ISBN: 9780203503973
- Tambwekar Shubhangi, *Handbook of Quality Assurance in Laboratory Medicines*, B. I. Publication, ISBN: 9788172253158
- WHO, (2004), *Laboratory safety Manual*, 3rd Ed., World Health Organization, ISBN 9241546506

Further reading :

Baird Rosamun, Hodges N. A., Denyer S. P.,(2000), *Handbook of Microbiological Quality Control in Pharmaceuticals and Medical Devices*, CRC Press. ISBN: 9780748406142

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Department of Biogas Research and Microbiology
B.Sc. Semester-VI

DSE-602 QUALITY ASSURANCE IN MICROBIOLOGY

(Syllabus of practicall portion) (In force from December 2020)
(External Evaluation: 60% + Internal Evaluation: 40%)
(Total Teaching Hours=45, Credit=1.5)

Learning Outcomes

- Developed practical skills for testing pharmaceutical products for sterility testing and pyrogenicity testing using different methods

1. Microbial Examination of sterile and Non Sterile Products
2. Test for Confirmation of Labeled LAL Reagent Sensitivity (LAL Test)
3. Antibiotic Potency Testing
4. Bioburden Estimation for Medical Devices

GUJARAT VIDYAPITH : AHMEDABAD

Faculty of Science and Applied Sciences, Sadra, Dist: Gandhinagar

Department of Biogas Research and Microbiology

B.Sc. Semester-6

DSE: 603 Hematology and Blood Banking

(Syllabus of theoretical portion) (In force from December 2020)

(External Evaluation: 60% + Internal Evaluation: 40%)

(Total Teaching Hours=45, Credit=03)

Objectives and Learning outcomes:

Upon successful completion of this course, the student should be able to understand the process of hematopoiesis; the general characteristics of different types of cells present in blood with their normal ranges and reasons for increase or decrease in specific cell type. They shall understand the maturation of each blood cell and the optimum conditions for hemopoiesis. They shall know about the blood vessels, platelets and their role in preventing the loss of blood from body; they shall understand the intrinsic and extrinsic blood coagulation pathways.

Students will know about the human blood group systems and their inheritance; they shall understand the principles of immunohematology. They will know the procedure for the selection and registration of donor followed by the process of blood collection.

They shall know about the storage, separation of blood components and their storage, changes that occur during storage and the expiration of different blood components.

The course will provide them an understanding about the significance of quality control in the blood bank; they shall also know about the ABO and Rh grouping (slide and tube method), direct and indirect Coomb's test, major and minor crossmatching and the emergency crossmatching procedures. They shall understand the transfusion reactions and incompatibility reactions like erythroblastosis fetalis.

Unit	Topics	Hours
1	i. Blood cells – general characters of RBC, WBC and platelets; production and maturation; haemoglobin	**11**
	ii. Haemostatis – role of blood vessels, role of platelets	
	iii. Blood coagulation – factors, intrinsic and extrinsic pathway	
2	i. Human blood group systems, principles of immuno hematology	**11**

	ii.	Blood collection – preparation for blood collection, criteria for the selection of donor, registration of donor and blood collection procedure	
3	i.	Transport and storage of blood – organization in storage, changes in stored blood, preparation and use of blood components	**11**
4	i.	Significance of quality control in blood bank, specimen collection for blood bank, laboratory preparations in blood bank	**12**
	ii.	Hemagglutination reactions – ABO grouping (slide and tube test), Rh blood typing (slide and tube test), Antihuman globulin (AHG) or Coombs test, compatibility testing (crossmatching) – major and minor, emergency crossmatching, Transfusion reactions and hemolytic disease of the newborn	

References:

1. Introduction to Medical Laboratory Technology, (7th Ed.) – F. J. Baker, R. E. Silverton, C. J. Pallister
2. Medical Laboratory Technology (Vol. I) – K .L. Mukherjee
3. Medical laboratory Technology – Godkar

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Department of Biogas Research and Microbiology

B.Sc. Semester-6

DSE: 603 Hematology and Blood Banking

(Syllabus of Practical portion) (In force from December 2020)

(External Evaluation: 60% + Internal Evaluation: 40%)

(Total Teaching Hours=45, Credit=1.5)

Skills: Students will develop the skill for assessing the basic blood parameters like hemoglobin, total count of RBCs, total count of WBCs, differential count of WBCs and the bleeding and clotting time.

1.Estimation of hemoglobin by Sahli's acid hematin method.

1. Total count of erythrocytes
2. Total count of leucocytes
3. Differential count of leucocytes by Field's method
4. Determination of bleeding time (dukes's method) and clotting time (wright's method)

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Department of Biogas Research and Microbiology
Semester 6: ENG 601: English
Learning Objectives and Syllabus
(External Evaluation: 60% + Internal Evaluation: 40%)
(Total Teaching Hours: 30, Credit: 2)

Learning Objectives:

1. To familiarize with the process of word formation and vocabulary development.
2. To understand various levels of word formation.
3. To develop the communication skills and personality skills.
4. To develop the skill of different kinds of written communications in formal settings.

Unit 1: Word Formation (20%; 6 Hours)

1. Affixes (Prefixes and Suffixes)
2. Clippings
3. Abbreviations
4. Compound Words
5. Blending

Unit 2: Speaking Skills (40%; 12 Hours)

1. Conducting Interviews
2. Appearing for Job Interviews
3. Telephonic Conversations

Unit 3: Writing Skills (40%; 12 Hours)

1. Job Application Letter
2. CV/Resume
3. Resignation Letter
4. Notice, Agenda, Minutes

List of Reference Books:

Rizvi, M. Ashraf. *Effective Technical Communication.* New Delhi: Tata McGraw Hill Publishing
Company Limited, 2005.
Tickoo, M. L. et al. Eds. *Stories, Plays and Tales of Adventure.* New Delhi: NCERT, 1996