College of Computer, Science & Information Technology - Junagadh

AFFILIATED TO BHAKTA KAVI NARSINH MEHTA UNIVERSITY

✦ Syllabus (NEP-2020) ✦

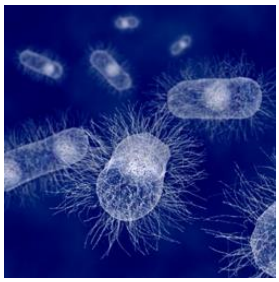
Bachelor of Science (Honours)

[MICROBIOLOGY]

[Semester – III & IV]

Academic Year : 2024 – 25

(Effective from June – 2024)



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Credit Structure

Semester – 3									
Sr. No.	Course Group (Major/Minor/MDC /SEC/AEC/VAC)	Paper No.	Course Paper Title	Credit	Ext. Marks (Theory)	Int. Marks (Theory)	Ext. Marks (Pract.)	Int. Marks (Pract.)	Total Marks
1	Major-5	MAJMBT301	Microorganisms : Classification & Significance (Theory)	4	50	50	--	--	100
2	Major-6	MAJMBT302	Applied Microbiology (Theory)	4	50	50	--	--	100
3	Major-7	MAJMBP303	Combine Practical	4	--	--	50	50	100
4	MDC-3	MDCBTT301	Environmental Biotechnology & Pollution	4	50	25	--	25	100
5	SEC-3	---	Microbiological Analysis of Air, Water & Soil to Pollution Control	2	25	25	--	--	50
6	AEC-3	---	English Language and Grammar-1	2	25	25	--	--	50
9	VAC-3	---	Indian Mythology: Avatars	2	25	25	--	--	50
Total Credits				22	Total Marks				550

Semester – 4									
Sr. No.	Course Group (Major/Minor/MDC /SEC/AEC/VAC)	Paper No.	Course Paper Title	Credit	Ext. Marks (Theory)	Int. Marks (Theory)	Ext. Marks (Pract.)	Int. Marks (Pract.)	Total Marks
1	Major-8	MAJMBT401	Microorganisms : Classification & Significance (Theory)	4	50	50	--	--	100
2	Major-9	MAJMBT402	Bioprocess Technology (Theory)	4	50	50	--	--	100
3	Major-10	MAJMBP403	Combine Practical	4	--	--	50	50	100
4	Minor-3	CHE203-2C	Chemistry	4	50	25	--	25	100
5	SEC-4	---	Chromatographic Techniques	2	25	25	--	--	50
6	AEC-4	---	English Language and Grammar-2	2	25	25	--	--	50
9	VAC-4	---	Agri. Engineering (Environmental Science-2)	2	25	25	--	--	50
Total Credits				22	Total Marks				550

General Instructions (Passing Standard) :

The standard of passing the B.Sc.(IT)/B.C.A. Degree Examination will be as under:

1. To pass any semester examination of the B.Sc. Degree, a candidate must obtain at least 40% marks in the university examination (External & Internal) with all sections (e.g. Theory, Practical & Internal) separately in each course.
2. Class will be awarded based on Earned Grade Points, SGPA and CGPA as per rules of University.

Syllabus of B.Sc.(Honours) Semester – III

Major-5 : Microorganisms: Classification and Significance (Theory)

Unit-1 : [Teaching Hrs. 15]

INTRODUCTION TO MICROBIAL DIVERSITY

- Introduction to Biodiversity- Microbial evolution and diversity
- Microbial Taxonomy: Introduction and overview
- Classification systems - Taxonomic ranks of microorganisms
- Major characteristics used in taxonomy
- Phylogeny- Survey of Prokaryotic Phylogeny and Phylogenetic Groups of Eukaryotes
- Introduction to metagenomics

Unit-2 : [Teaching Hrs. 15]

PROKARYOTIC DIVERSITY

- Introduction to Archaea and Eubacteria
- Gram negative bacteria – General features of:
- Aerobic/Microaerophilic motile, helical vibriod
- Non-motile curved bacteria
- Aerobic/Microaerophilic rods and cocci
- Facultative anaerobes – rods, curved and helical bacteria
- Dissimilatory Sulfate reducers, Anaerobic cocci, Phototrophic bacteria
- Gram positive bacteria – General features of:
- Endospore forming rods and cocci
- Asporogenous rods, Mycobacteria and Actinomycetes
- Extremophilic Microorganisms

Unit-3 : [Teaching Hrs. 15]

EUKARYOTIC DIVERSITY

FUNGI:

- General characteristics: Definition, occurrence, Structure, Reproduction
- Classification and introduction to major divisions of Fungi
- Economic importance of fungi

ALGAE:

- General Characteristics: Definition, Occurrence, Ultra- Structure, Reproduction
- Economic importance of Algae

PROTOZOA:

- General Characteristics: Definition, Occurrence, Ultra- Structure, Reproduction
- Economic importance of Protozoa

Unit-4 : [Teaching Hrs. 15]

AKARYOTIC DIVERSITY(VIRUSES)

- Introduction and General Characteristics: Definition, Structure, Classification
- Cultivation and Enumeration of Viruses
- Bacterial Viruses: Classification, Lytic life cycle (T4 phage), lysogenic life cycle (Lambda phage)
- Introduction to Animal Viruses: Classification, Replication, Cytocidal effects, Viruses and Cancer, Prions
- Introduction to Plant Viruses: Classification, Structure & Replication of TMV, Economic importance, Viroids

Suggested Reading:

1. Prescott, Healey and Klein., Microbiology-5th International Edition, Tata-McGraw Hill publications, Delhi
2. Atlas. R.M., Principles of Microbiology- 2nd Edition
3. Tortora, Funke & Case. Microbiology-An Introduction, 8 Edition, Pearson Education
4. Modi, H.A. Elementary Microbiology - Vol -I, Akta Prakashan, Nadiyad
5. Pelczar, M.J., Chan E.C.S., Krieg, N.R., Microbiology, 5 Edition. Tata McGraw Hill Publication Co. Ltd.
6. Stainer, R.Y., Iingraham, J.L., Wheelis, M.L., Painter, R.K. General Microbiology, 5th Edition. MacMillan Press Ltd., London
7. Frobisher M., Hinsdill, Crabtree and Goodherat, Fundamentals of Microbiology, 9th Edition. W.B Saunders Co. USA
8. Dubey, R.C.and Maheshwari, D.K., A Text Book of Microbiology, S. Chand Publications, New Delhi.
9. Powar and Daginawala, General Microbiology Vol-II. Himalaya Publishing House, Mumbai
10. Mani, A., Selwaraj, A.M., Narayanan L.M., and Arumngam, N., Microbiology, Saras Publication, Delhi

Major-6 : Applied Microbiology (Theory)

Unit-1 : [Teaching Hrs. 15]

SOIL AND AGRICULTURAL MICROBIOLOGY

- Physical & Chemical Characteristics of Soil
- Rhizosphere & Microbial flora of Soil
- Interactions among soil microorganisms: Neutral, Beneficial & Harmful interactions
- Introduction to sedimentary and gaseous biogeochemical cycles and role of microorganisms
- Nitrogen fixation and Winogradsky's column
- Pathogens for plant diseases: Plant mycology, Plant bacteriology and Plant virology
- Management of plant disease
- Biofertilizers, Biopesticide and biocontrol

Unit-2 : [Teaching Hrs. 15]

FOOD MICROBIOLOGY

- Microbial flora of fresh food
- Microbial spoilage of foods: Fresh foods & Canned foods
- Food Borne infection & intoxication: Role of *S.aureus*, *C.botulinum* & *Salmonella* Spp.in food poisoning
- Preservation of foods: General principles & methods of food preservation
- Microbiological examination of food; Introduction to AGMark
- Brief introduction about fermented foods: Pickles, Sauerkraut, Silage, Sausages & Bread
- Microorganisms as food: Single Cell Protein, Mushrooms and Functional foods

Unit-3 : [Teaching Hrs. 15]

DAIRY MICROBIOLOGY

- Milk as a medium, normal flora of milk
- Types of microorganisms in milk: Biochemical types, Pathogenic types, Temperature types
- Spoilage of milk & milk products
- Microbial analysis of milk: SPC, Direct count, MBRT, Resazurin test
- Grading of milk
- Fermented milk Beverages & Manufactured Dairy Products: Starter Culture,
- Cheese, Yogurt, Buttermilk, Acidophilus milk, Kefir
- Preservation of milk: Principles & methods of preservation

Unit-4 : [Teaching Hrs. 15]

PHARMACEUTICAL MICROBIOLOGY

- Introduction to pharmaceutical microbiology and pharmacopoeia
- Sterility testing of pharmaceutical products
- Quality assurance and validation: GMP and GLP in pharmaceutical industries
- Quality assurance and quality management in pharmaceuticals: ISO, WHO and other certifications
- Total Quality Management

Suggested Reading:

1. Principles of Microbiology by Atlas R.M.: 2nd edition
2. Microbiology by Pelczar M.J. & Chain E.C.S.: 5th edition
3. Introduction to soil microbiology by Alexander M: 2nd edition
4. Biotechnology fundamental & applications By Purohit S.S.
5. Diseases of Crop plants in India by Rangaswami G.
6. Microbiology fundamental & applications By Purohit S.S.
7. Fundamentals of Microbiology by Frobisher M.: 9th edition
8. Industrial Microbiology by Prescott S.C.: 3rd edition
9. Food Microbiology by Frazier W.C.: 3rd edition
10. Food science & Experimental foods By Swaminathan M.
11. Modern food microbiology by J James
12. Fundamentals of Dairy Microbiology by Prajapati J.B.
13. Pharmaceutical Microbiology by Ashutosh Kar, New Age International Publishers
14. Pharmaceutical Microbiology – Edt. by W.B.Hugo & A.D.Russell 6th edition. Blackwell scientific Publications.
15. Quality control in the Pharmaceutical Industry - Edt. by Murray S. Cooper Vol.2. Academic Press New York

Major-7 : Combine Practical (Practical)

Sr. No.	Practical Content	Teaching Hrs.
1	Isolation of Gram-negative bacteria from the given sample.	60 Hrs.
2	Identification of Gram negative bacteria from the given pure culture using biochemical media (*E.coli, Entrobacter aerogens, Proteus, Salmonella*)	
3	Isolation of Gram-positive bacteria from the given sample.	
4	Identification of Gram-positive bacteria from the given pure culture using biochemical media (*Bacillus megaterium, Bacillus subtilis, staphylococcus aureus, Streptococcus*)	
5	Identification of Fungi on the basis of Morphological Characteristics.	
6	Cultivation of yeast from different natural samples and its morphological characterization using microscopic observation.	
7	Microscopic observation of different algae from the given samples.	
8	Microscopic observation of different protozoa from the given sample.	
9	Isolation and cultivation of bacteriophage of *E. coli* from the given sewage sample.	
10	Isolation of nitrogen fixing bacteria	
11	Cultivation of nitrifying and denitrifying bacteria (Demo)	
12	Cultivation and microscopic observation of cyanobacteria	
13	study of oozing, and isolation of pathogen from diseased specimen of lemon leaf showing citrus canker and isolation of *Xanthomonas* spp.	
14	Construction of Winogradasky column	
15	Standard qualitative analysis of milk	
16	Methylene Blue Reduction Time test for milk	
17	Preparation of Yogurt/Dahi	
18	Sampling of pharmaceuticals for microbial contamination and load (syrups, suspensions, creams and ointments, ophthalmic preparations)	
19	Sterility testing by *Bacillus stearothermophilus*	

Suggested reading

1. Patel. R.J., Patel. K.R., Experimental Microbiology, Vol-I, Aditya Publications, Ahmedabad, India.
2. Patel. R.J., Patel. K.R., Experimental Microbiology, Vol-II, Aditya Publications, Ahmedabad, India.
3. Dubey. R.C., Maheshwari. D.K., Practical Microbiology, S.Chand & Company Ltd., New Delhi
4. Konika Sharma., manual of Microbiology – Tools & Techniques, Ane Books, Delhi.

MDC-3 : Environmental Biotechnology & Pollution (Theory)

Unit-1 : [Teaching Hrs. 15]

ECOSYSTEM AND ITS COMPONENT

1.1Terrestrial Biomes: - Deserts, Grasslands, Tundra & Forests and Aquatic Biomes: Freshwater & Saline Ecosystem

1.2 Biogeochemical Cycles: Nitrogen, Carbon & Sulfur cycle

1.3 Interaction within, between & among populations

1.4 Population Ecology, Population characteristics, Models of population growth and Interactions

Unit-2 : **[Teaching Hrs. 15]**

ENVIRONMENTAL POLLUTIONS AND ITS REMEDIES

2.1 Overview: Biodegradation of Hydrocarbon & Xenobiotics
2.2 Biodegradation of DDT, Nitrobenzene
2.3 An overview of process of Bioremediation & Biomagnification
2.4 Conventional Air Pollutants & Acid rain & Acid mine drainage

Unit-3 : **[Teaching Hrs. 15]**

MICROBIAL APPLICATION IN ENVIRONMENT

3.1 Physical, Chemical & Biological properties of water and waste-water
3.2 Primary, Secondary and Tertiary treatment processes
3.3 Biofertilizers and Biocontrol
3.4 Bioleaching and Bioplastics

Unit-4 : **[Teaching Hrs. 15]**

HORMONES

4.1 Introduction to Hormones: Endocrine and Exocrine
4.2 Plant Hormones and its functions
4.3 Animal Hormones and its functions
4.4 Types of Animal Hormones

Suggested Reading:

1. Prescott, Healey and Klein., Microbiology-5th International Edition, Tata-McGraw Hill publications, Delhi
2. Richard H. Baltz. Julian E Davies and Arnold L. Demain Manual of Industrial Microbiology and Biotechnology. 3rd edition, ASM Press (2010).
3. Daniel Forciniti. Industrial Bioseperation: Principles and practice. 1st edition edition, Wiley Blackwell (2008).
4. Reed. G. Prescott and Dunn's Industrial Microbiology. CBS Publishers. (1999).
5. Demain, A. L. Industrial Microbiology and Biotechnology. 2nd Edition. (2001).
6. EL Mansi. E.M.T., Fermentation Microbiology and Biotechnology. 2nd Edition, CRC Taylor & Francis (2007).
7. Waites, M.J., Morgan, N.L., Rockey, J.S. and Higton, G. Industrial Microbiology: An lntroduction. Blackwell Science Publishers (2002).
8. Stainer, R.Y., Iingraham, J.L., Wheelis, M.L., Painter, R.K. General Microbiology, 5th Edition. MacMillan Press Ltd., London
9. Frobisher M., Hinsdill, Crabtree and Goodherat, Fundamentals of Microbiology, 9th Edition. W.B Saunders Co. USA
10. Dubey, R.C.and Maheshwari, D.K., A Text Book of Microbiology, S. Chand Publications, New Delhi.
11. Powar and Daginawala, General Microbiology Vol-II. Himalaya Publishing House, Mumbai
12. Casida LE, Industrial Microbiology, J. Wiley, (1968).

MDC-3 : Environmental Biotechnology & Pollution (Practical)

Sr. No.	Practical	Teaching hours
1	Study yeast cell immobilization in calcium alginate gels	30
2	Study enzyme immobilization by sodium alginate method	
3	Winogradsky column preparation	
4	Estimate the Phosphate content of soil	
5	Determine the pH, temperature and texture of soil	
6	Water holding capacity of soil	
7	Soil moisture by oven drying method	

SEC-3 : Microbiological Analysis of Air, Water & Soil to Pollution Control (Theory)

Unit-1 : **[Teaching Hrs. 08]**

Aero-Microbiology

- Aero- microbiology: Bioaerosols, Air borne microorganisms (bacteria, Viruses, fungi) and their impact on human health and environment,
- Significance in food and pharma industries and operation theatres, allergens.

Unit-2 : **[Teaching Hrs. 08]**

Water-Microbiology

- Water borne pathogens, water borne diseases.
- • Sample Collection, Treatment and safety of drinking(potable)water, methods to detect potability of water samples:
  (a) standard qualitative procedure: presumptive/MPN tests, confirmed and completed tests for faecal coliforms
  (b) Membrane filter technique and Presence/absence tests

Unit-3 : **[Teaching Hrs. 07]**

Control Measures

- Control Measures: Fate of bioaerosols, inactivation mechanisms – UV light, HEPA filters, desiccation, Incineration.
- Precipitation, chemical disinfection, filtration, high temperature, UV light

Unit-4 : **[Teaching Hrs. 07]**

Soil Microbiology

- Soil-microbiology: Soil borne pathogens, soil borne diseases, Sampling of soil, sample collection and analysis.
- Isolation and identification of pathogens. Soil testing methods. Soil treatment.

Suggested Reading:

1. Medigan, M.T., Martinko, J. M. and Parker, J. Brock Biology of Microorganisms. Pearson
   a. Education Inc., New York
2. Alexander, M John. Microbial ecology. Wiley & Sons, Inc., New York.
3. Alexander, M John. Introduction to soil microbiology.Wiley & Sons Inc., New York.
4. Barker, KH, and Herson, D.S. Bioremediation. Mc Craw Hill Inc., New York.
5. Chapelle, F.H. Ground Water Microbiology and Geochemistry. New York: John Wiley & Sons, 2000.
6. K.R. Aneja. Laboratory Manual of Microbiology and Biotechnology New Age Publications.2014

SEC-3 : Microbiological Analysis of Air, Water & Soil to Pollution Control (Practical)

Sr. No.	Practical content	Teaching Hrs.
1.	Chemical analysis of water: Chloride, Hardness, Nitrite Nitrogen, Alkalinity, Acidity, TDS, TSS, TS	30
2.	Isolation and Determination of air flora and air density from indoor & outdoor sources.	
3.	Isolation and identification of coli forms from Water by Presumptive, Confirmed & Completed test.	
4.	Isolation and cultivation of bacteriophage of *E.coli* from the given sewage sample	
5.	Field Visit to Sewage treatment plant / Forest / Sanctuary / Soil Research Laboratory / Environmental laboratory/ GPCB Station and preparation of report	
6.	Study the prevention and control of organism using UV light.	
7.	Study the filtration techniques to study the control of organisms.	

Suggested reading

1. Patel. R.J., Patel. K.R., Experimental Microbiology, Vol-I, Aditya Publications, Ahmedabad, India.
2. Patel. R.J., Patel. K.R., Experimental Microbiology, Vol-II, Aditya Publications, Ahmedabad, India.
3. Dubey. R.C., Maheshwari. D.K., Practical Microbiology, S.Chand & Company Ltd., New Delhi
4. Konika Sharma., manual of Microbiology – Tools & Techniques, Ane Books, Delhi.

AEC-3 : ENGLISH LANGUAGE & GRAMMAR–1

Table of Contents

Unit No.	Syllabus Contents	Teaching Hours
1	**Short stories:** The Secret of Culture by Munshi Premchand (https://www.arvindguptatoys.com/arvindgupta/ruskin-stories.pdf) The Last Question by Issac Asimov (https://users.ece.cmu.edu/~gamvrosi/thelastq.html) **Essays:** Why We Crave Horror Movies by Stephen King (https://faculty.uml.edu/bmarshall/lowell/whywecravehorrormovies.pdf) Ebooks v paper by Julian Baggini • (https://www.ft.com/content/53d3096a-f792-11e3-90fa-00144feabdc0#axzz35eMWcGoS)	**15**
2	**Grammar:** Active-Passive voices **Composition:** Report writing • (List of topics has been given)	**15**

Suggested Reading:

1. Intermediate English Grammar: Reference and Practice for South Asian Students by Raymond Murphy. Cambridge University Press
2. Business Communication by Urmila Rai and S.M. Rai. Himalaya Publishing House
3. Effective Technical Communication by M Ashraf Rizvi. Tata Mc Graw hill
4. Spoken English: A Foundation Course by Kamlesh Sadanand and Susheela Punitha (Part I and Part II)

Topics for report writing:

1. **Cultural Festivals:** Describe a cultural festival celebrated in your community or country.
2. **Sports Events:** Report on a recent sports event such as a cricket match, football game, or tennis tournament.
3. **Concerts or Music Festivals:** Write about a concert or music festival you attended, describing the performers and atmosphere.
4. **School or University Events:** Report on a school play, science fair, or university lecture.
5. **Art Exhibitions:** Write about an art exhibition you visited, discussing the artworks and artists.
6. **Charity Events:** Report on a charity run, fundraiser, or volunteer activity you participated in.
7. **Film Screenings or Premieres:** Describe a film screening or premiere you attended, discussing the movie and audience reactions.
8. **Science or Technology Conferences:** Write about a conference or expo focused on science, technology, or innovation.
9. **Book Fairs or Literary Events:** Report on a book fair or literary event you attended, discussing authors and books.

VAC : INDIAN KNOWLEDGE SYSTEM-2(IKS)

INDIAN MYTHOLOGY : AVATARS

Purposes:

1. Students develop social consciousness for the preservation of youth.
2. As the universe moves along the path of innumerable literal impulses.

Course Objectives:

- To expose students to rich cultural knowledge f avatars
- To understand myth and message behind each avatar tale
- To understand concept of avatars in modern light
- To spread awareness on Indian knowledge system

Course Learning Outcomes:

- After completion of the course:
- Students will be able to understand the concept of avatar in Indian mythology.
- Students will be able to identify myths and message behind them.
- Students will be able to understand impact of myth on public life.
- Students will be able to evaluate Indian myths on avatars and their modern retelling.

Course Contents:

Unit No.	Syllabi	Teaching Hours
1	• Matsya avatar • Kurma avatar • Varah avatar • Narsimha avatar • Vamana avatar	15
2	• Parashuram avatar • Rama avatar • Krishna avatar • Buddha avatar • Kalki avatar	15

Suggested Reading:

1. Mythology of Vishnu and His Incarnations by M. L. Varadpande
2. Indian Mythology by Devdutt Pattanaik
3. Unusual Tales from Indian Mythology by Sudha Murty
4. Indian Mythology: Vedic and Puranic by William Wilkins

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Syllabus of B.Sc.(Honors) Semester – IV

Major-8 : Molecular Biology and Bioengineering (Theory)

Unit-1: [Teaching Hrs. 15]

History and Concept of Genetics

- History of genetics and molecular biology
- Mendelian Laws of inheritance

The Gene Concept

- Units of genetic structure and genetic function
- Gene Cistron relationship in Prokaryotes and Eukaryotes
- Gene structure and architecture
- DNA is the universal genetic material
- DNA replication – mechanism and models

Unit-2: [Teaching Hrs. 15]

Gene Expression and Regulation

- Transcription and post transcriptional modifications
- Genetic code and Ribosome
- Translation and post translational modifications
- Levels of gene expression and regulation
- Types and principles of gene regulation
- Transcriptional regulation
- The Operon Model: Regulation of lactose utilization – The lac operon
- The Operon Model: Regulation of arabinose utilization – The ara operon
- The Operon Model: Regulation of tryptophan biosynthesis – The trp operon
- Post transcription control

Unit-3: [Teaching Hrs. 15]

Gene Transfer and Recombination

- Types of Recombination: Homologous recombination, Site specific recombination, Illegitimate recombination
- Transformation: Natural transformation, competence, DNA uptake, role of natural transformation, Artificial induced competence, electroporation
- Transduction: Generalized transduction, Specialized transduction and Abortive transduction
- Conjugation: Mechanism of DNA transfer in Gram positive and Gram-negative bacteria
- Transposable genetic elements

Unit-4: [Teaching Hrs. 15]

Genetic and Protein Engineering

- Genetic engineering: aims and applications
- Genetic manipulations of prokaryotes:
- Isolation of DNA
- Vectors of Recombinant-DNA Technology – pBR322, pUC, Bacteriophages, Cosmid, Phagmid, BACs, YACs
- Insertion of DNA molecules into a vector
- Transformation and Growth
- Detection of Recombinant molecules – Colony Hybridization
- Expression of foreign DNA
- Genetic manipulations of eukaryotes: Genetic manipulation of plant cells, animal cells and yeasts
- Site directed mutagenesis

Suggested Reading:

1. Advanced Molecular Biology, Twyman R. M.
2. Genes VII, Benjamin Lewin
3. Microbiology, Atlas R. M.
4. Essential of Molecular Biology – Malacinski G. M.
5. Molecular Genetics of Bacteria – Synder L. & Champness
6. Microbial Genetics – R. Maloy
7. Microbiology – Prescott L. M.
8. Microbial Genetics – Freifilder. D
9. Principles of Gene Manipulation – Old and Primrose
10. Biotechnology – Trevan M.D.

Major-9 : Bioprocess Technology (Theory)

Unit-1: [Teaching Hrs. 15]

Fermentation Technology and Strain Improvement

Historical perspective and concept

- General Concept and historical development of industrial microbiology
- Range of Fermentation Processes
- Component parts fermentation process
- Economic aspects of fermentation industry

Isolation & strain improvement

- Primary & Secondary Screening
- Isolation methods using selection of desired characters
- Improvement of industrially important microbes: Application of protoplast fusion and recombinant DNA technology

Unit-2: [Teaching Hrs. 15]

Formulation of Fermentation Media

- Introduction to Media and its Types
- Media formulation
- Raw materials: Crude Carbon and Nitrogen sources, Minerals, Precursors, Growth Regulators, Buffers, Antifoam agents
- Inoculum and Production medium
- Media Optimization

Unit-3: [Teaching Hrs. 15]

Design and Aseptic Operation

- Introduction and basic functions of fermentor
- Criteria for design of a fermentor
- Types of bioreactors
- Aeration and Agitation
- Fermentation process: Batch Fermentation, Continuous fermentation and their comparative advantages and disadvantages
- Sterilization process in fermentation industries:
  a. Introduction of Del factor
  b. Fermentor sterilization
  c. Medium sterilization
  d. Sterilization of air and feed
- Aseptic operation, Containment and its categorization

Unit-4: [Teaching Hrs. 15]

Fermentation Processes

- Production of organic solvents: Ethyl alcohol
- Production of enzymes: Amylases and Proteases
- Production of antibiotics: Penicillin and Streptomycin
- Production of amino acids: Lysine
- Production of organic acids: Citric acid
- Production of vitamins: Riboflavin
- Overview of Immobilization in fermentation process

Suggested Reading:

1. Principles of Fermentation Technology by Stanbury & Whittaker: 2nd edition.
2. Industrial Microbiology by Casida L.E.
3. A text book of Industrial Microbiology, 2nd edition by Wulf Crueger & Anneliese Crueger.
4. Industrial Microbiology by A.H. Patel.
5. Biotechnology: Food Fermentation Microbiology, Biochemistry & Technology vol. 1 & 2 by V.K. Joshi & Ashok Pandey.
6. Biotechnology By M.D.Trevan.

Major-10 : Combine Practical (Practical)

Sr. No.	Practical Content	Teaching Hrs.
1	Isolation of DNA (only demonstration experiment).	60 Hrs.
2	Estimation of DNA	
3	Conjugation in *E. coli* by plate method.	
4	Isolation of plasmid (Only demonstration experiment)	
5	Transformation of plasmid.	
6	Isolation and extraction of protein.	
7	Estimation of protein	
8	Primary screening of industrially important microorganisms capable of producing: Antibiotics, Organic acids, amylases	
9	Bioassay of penicillin using *Bacillus*. spp.	
10	Laboratory fermentation & estimation of Ethyl Alcohol by Saccharomyces	
11	Laboratory fermentation & estimation of amylase by *Bacillus* spp.	
12	Sterility testing of fermentation products	
13	Immobilization of yeast cells by Ca- alginate entrapment method	
14	Methylene Blue Reduction Time test for milk	
15	Fermentation production & estimation of citric acid	

Suggested reading

1. Patel. R.J., Patel. K.R., Experimental Microbiology, Vol-I, Aditya Publications, Ahmedabad, India.
2. Patel. R.J., Patel. K.R., Experimental Microbiology, Vol-II, Aditya Publications, Ahmedabad, India.
3. Dubey. R.C., Maheshwari. D.K., Practical Microbiology, S. Chand & Company Ltd., New Delhi
4. Konika Sharma., manual of Microbiology – Tools & Techniques, Ane Books, Delhi.
5. International student edition: Microbiology- A laboratory Manual 4th edition. by James G. Chappuccino & Natalie Sherman.

Minor-03 : Chemistry (Theory)

Unit-1 : [Teaching Hrs. 15]

Chapter-1 Oils and Fats

Introduction, Properties of oil and fats, Classification, Hydrogenation of oil:

i) Optimum condition for the hydrogenation process and ii) Preparation of Nickel catalyst,

Process for hydrogenation of oil:

i) Dry process and

ii) Wet process,

Analysis of oil and fats:

i) Saponification value ii) Acid value

iii) Iodine value(WIJS method) and iv) Reichert – Meisel value.

Unit-2 : [Teaching Hrs. 15]

Chapter-2 Soap and Detergent

Introduction, Raw materials for manufacture, Methods for manufacture of soap (i) Batch process (ii) Continuous process Types of soap: Toilet soap, transparent soap, shaving soap, Neem soap,

Introduction to detergents, Principal group of synthetic detergents, Bio-degradability of surfactants, Classification of surface-active agents, Anionic detergents,

Manufacture of anionic detergents; (i) Oxo Process (ii) Alfol Process, (iii) Welsh Process

Cationic detergents, Non – Ionic detergents, amphoteric detergents

Unit-3 : **[Teaching Hrs. 15]**

Chapter-3

Environmental Chemistry

Environment – definition and introduction, Segments of environment (i) Atmosphere (ii) Hydrosphere (iii) Lithosphere (iv) Biosphere, Air Pollution: Major sources of air pollution, Control of Air pollution, Green House Effect, Photochemical smog, CFC and ozone depletion, Acid rain, Sources and effects of NOX and SOX, Environmental pollution and its type.

Unit-4 : **[Teaching Hrs. 15]**

Chapter-4 Chromatography

Introduction, Classification of chromatography - types of chromatography, Principle of Chromatography

Column chromatography: Principle, Adsorbents, Preparation of column, Method, Separation of green leaf pigment,

Paper chromatography: Introduction**,** Principle, Types of Paper Chromatography (Ascending and Descending, Two dimensional; Circular), Migration parameters (Rf value and Rx value), Spotting and Visualization. Separation of amino acids and metal ions (Fe^{+}, Co^{+2}, Ni^{+2}) mixture using spray reagent ninhydrine and aniline phthalate

TLC: Introduction, Principle, Method of preparation of chromplate, Experimental techniques, Superiority of TCL over other chromatographic Techniques, Application of TLC.

Gas chromatography: Introduction, Types, Principle of GLC and GSC, Instrumentation, Carrier gas and Solvent, Column and Detectors (Briefly), Advantages of gas chromatography

Ion Exchange chromatography: Introduction, Definition and Principle, Type of resins, Properties of ion exchange resins, Factors affecting separation of ions, Ion exchange capacity, Applications (Removal of interfering ion, Softening of water, Demineralization of water, Separation of lanthanides)

Minor-03 : Chemistry (Practical)

Unit – 2 : Chromatography **Teaching Hrs. 30**

Atleast Six practicals may be given.

1. To determine Rf value of individual amino acids in a mixture of amino acid by ascending paper chromatography.
2. To determine Rf value of individual and mixture of amino acid by circular paper chromatography.
3. To determine Rf value of individual and mixture of amino acid by thin layer chromatography (TLC).
4. To determine Rf value of individual and mixture of metal ions by ascending paper chromatography.
5. To determine Rf value of individual and mixture of metal ions by circular paper chromatography.
6. To determine Rf value of individual and mixture of two sugars by ascending paper chromatography.
7. Separation of a mixture of o-and p-nitrophenol or o-and p-aminophenol by thin layer chromatography (TLC)
8. Separation and identification of the monosaccharides present in the given mixture (glucose & fructose) by paper chromatography. Reporting the Rf values.

Suggested Reading:

1. Principles of Inorganic chemistry – Puri, Sharma & Kalia
2. Concise Inorganic Chemistry - J. D. Lee
3. Advanced Inorganic Chemistry- Cotton and Wilkinson
4. Basic Inorganic Chemistry - Gurdeep & Chatwal
5. Organic Chemistry (Volume I, II & III) by S.M. Mukherji, S.P. Singh and R.P. Kapoor
6. A Text Book of Organic Chemistry (II Edition) by Raj K. Bansal
7. Name Reactions in Organic Synthesis by Dr. A.R.Parikh et. Al
8. Reactions and Rearrangements by Gurdeep Chatwal
9. Essentials of Physical Chemistry, B. S. Bahl, G. D. Tli and Arun Bahl, S. Chand & Co. New Delhi
10. Elements of Physical Chemistry, Late B.R. Puri, L. R. Sharma and Madan
11. Pathania, Vishal Publishing Co. Jalandhar
12. Principles of Physical Chemistry, Samule H. Maron and Carl F. Prutton, Oxford & IBH Publishing Co. Pvt. Ltd. New Delhi
13. Physical Chemistry, B. K. Sharma, Goel Publication House. Meerut.
14. Quantum chemistry by A. K. Chandra
15. Basic Concept of Quantum Chemistry by R. K. Das.
16. Molecular Physical Chemistry by McQuarrie
17. Elements of Physical Chemistry, Samuel Glasstone and David Lewis, Macmillan & Co.

18. Engineering Chemistry by Jain and Jain
19. Industrial Chemistry by B.K. Sharma
20. Thermodynamics by Gurudeeep Raj
21. Thin Layer Chromatography by Egal Stall
22. Thermodynamics for Chemists by Samuel Glasstone
23. A Textbook of Quantitative Inorganic Analysis by A. I. Vogel
24. Inorganic inflictive analysis by Vogel and Gehani Parekh
25. Reigel's Handbook of Industrial Chemistry by James A. Kent
26. Fundamental of Analytical Chemistry by Skoog and West
27. Instrumental Methods of Chemical Analysis by B. K. Sharma
28. Instrumental Method of Chemical Analysis by Chatwal Anand
29. Analytical Chemistry by Dick
30. Electrometric Methods of Analysis by Browning
31. Principle of Instrumental Methods of Analysis by Skoog.
32. Mikes, O. & Chalmes, R.A. Laboratory Hand Book of Chromatographic & Allied
33. Methods, Elles Harwood Ltd. London.
34. Ditts, R.V. Analytical Chemistry – Methods of separation.
35. Jack T. Ballinger; Gersshon J. Shugar. Chemical Technicians' Ready Reference Hand book, 5th Edition, 2011, ISBN:9780071745925, The McGraw-Hill com, Incpanies

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SEC-4 : Chromatographic Techniques (Theory)

Unit-1 : **[Teaching Hrs. 7]**

Chromatography:

Introduction, Classification of chromatography - types of chromatography, Principle of Chromatography

Column chromatography: Principle, Adsorbents, Preparation of column, Method, Separation of green leaf pigment,

Paper chromatography: Introduction**,** Principle, Types of Paper Chromatography (Ascending and Descending, Two dimensional; Circular), Migration parameters(Rf value and Rx value), Spotting and Visualization. Separation of amino acids and metal ions (Fe^{+}, Co^{+2}, Ni^{+2}) mixture using spray reagent ninhydrine and aniline phthalate

TLC: Introduction, Principle, Method of preparation of chromplate, Experimental techniques, Superiority of TCL over other chromatographic Techniques, Application of TLC.

Unit-2 : **[Teaching Hrs. 7]**

Gas chromatography: Introduction, Types, Principle of GLC and GSC, Instrumentation, Carrier gas and Solvent, Column and Detectors (Briefly), Advantages of gas chromatography

Ion Exchange chromatography: Introduction, Definition and Principle, Type of resins, Properties of ion exchange resins, Factors affecting separation of ions, Ion exchange capacity, Applications (Removal of interfering ion, Softening of water, Demineralizationof water, Separation of lanthanides)

SEC-4 : Chromatographic Techniques (Practical)

Chromatography :- **[Teaching Hrs. 30]**

Atleast six practicals may be given.

1. To determine Rf value of individual amino acids in a mixture of amino acid by ascending paper chromatography.
2. To determine Rf value of individual and mixture of amino acid by circular paper chromatography.
3. To determine Rf value of individual and mixture of amino acid by thin layer chromatography (TLC).
4. To determine Rf value of individual and mixture of metal ions by ascending paper chromatography.
5. To determine Rf value of individual and mixture of metal ions by circular paper chromatography.
6. To determine Rf value of individual and mixture of two sugars by ascending paper chromatography.
7. Separation of a mixture of o-and p-nitrophenol or o-and p-aminophenol by thin layer chromatography (TLC)
8. Separation and identification of the monosaccharides present in the given mixture (glucose & fructose) by paper chromatography. Reporting the Rf values.

Suggested Reading:

1. Principles of Inorganic chemistry – Puri, Sharma & Kalia
2. Concise Inorganic Chemistry - J. D. Lee
3. Advanced Inorganic Chemistry- Cotton and Wilkinson
4. Basic Inorganic Chemistry - Gurdeep & Chatwal
5. Organic Chemistry (Volume I, II & III) by S.M. Mukherji, S.P. Singh and R.P. Kapoor
6. Engineering Chemistry by Jain and Jain
7. Industrial Chemistry by B.K. Sharma
8. Handbook of practical chemistry by shubhash and satish
9. Thin Layer Chromatography by Egal Stall
10. Chromatographic separation by Tata McGraw Hill
11. A Textbook of Quantitative Inorganic Analysis by A. I. Vogel
12. Inorganic qualitative analysis by Vogel and Gehani Parekh
13. Reigel's Handbook of Industrial Chemistry by James A. Kent
14. Fundamental of Analytical Chemistry by Skoog and West
15. Instrumental Methods of Chemical Analysis by B. K. Sharma
16. Instrumental Method of Chemical Analysis by Chatwal Anand
17. Analytical Chemistry by Dick
18. Electrometric Methods of Analysis by Browning
19. Principle of Instrumental Methods of Analysis by Skoog.
20. Mikes, O. & Chalmes, R.A. Laboratory Hand Book of Chromatographic & Allied Methods, Elles Harwood Ltd. London.
21. Ditts, R.V. Analytical Chemistry – Methods of separation.
22. Jack T. Ballinger; Gersshon J. Shugar. Chemical Technicians' Ready Reference Hand bok, 5th Edition, 2011, ISBN:9780071745925, The McGraw-Hill com, Incpanies

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AEC-4 : ENGLISH LANGUAGE & GRAMMAR–2

Table of Contents

Unit No.	Syllabus Contents	Teaching Hours
1	**Short stories:** 1. The Story of an Hour by Kate Chopin (https://archive.vcu.edu/english/engweb/webtexts/hour/) 2. The Seventh Pullet by H. H. Munro (Saki) (https://www.arvindguptatoys.com/arvindgupta/ruskin-stories.pdf) **Essays:** 1. On the Phenomenon of Bullshit Jobs: A Work Rant by David Graeber (https://www.strikemag.org/bullshit-jobs/) 2. The Medium Really is the Message by Ezra Klein (https://www.nytimes.com/2022/08/07/opinion/media-message-twitter-instagram.html)	**15**
2	**Comprehension:** Proverbs **Composition:** Essay writing • (List of topics has been given)	**15**

Suggested Reading:

1. Intermediate English Grammar: Reference and Practice for South Asian Students by Raymond Murphy. Cambridge University Press
2. Business Communication by Urmila Rai and S.M. Rai. Himalaya Publishing House
3. Effective Technical Communication by M Ashraf Rizvi. Tata Mc Graw hill
4. Spoken English: A Foundation Course by Kamlesh Sadanand and Susheela Punitha (Part I and Part II)

List of topics for essay writing: (in 350 to 450 words)

- ✓ **Personal Topics:**
- ✓ **The Influence of Family on My Life:** Discuss how your family has impacted your values, beliefs, and aspirations.
- ✓ **A Memorable Travel Experience:** Describe a memorable trip you've taken and its impact on your perspective.
- ✓ **My Dreams and Ambitions:** Reflect on your dreams and aspirations for the future and how you plan to achieve them.
- ✓ **Critical Topics:**
- ✓ **The Impact of Social Media on Society:** Analyze the effects of social media on individuals and communities.
- ✓ **Media Influence on Body Image:** Critically examine the portrayal of body image in the media and its impact on self-esteem.
- ✓ **The Impact of online shopping on the lifestyle:** Critically evaluate the consequences of online shopping on the individuals and society.

Contemplative Topics:

- **The Meaning of Success:** Contemplate what success means to you and how you measure it.
- **Embracing Change:** Reflect on the inevitability of change and how to adapt to it.
- **The Beauty of Simplicity:** Reflect on the value of simplicity in a complex world.

List of Proverbs:

1. A bird in the hand is worth two in the bush.
2. Absence makes the heart grow fonder.
3. Actions speak louder than words.
4. All good things must come to an end.
5. All is fair in love and war.
6. All that glitters is not gold.
7. An apple a day keeps the doctor away.
8. As you sow, so shall you reap.
9. Beggars can't be choosers.
10. Better late than never.
11. Better safe than sorry.
12. Birds of a feather flock together.
13. Blood is thicker than water.
14. Charity begins at home.
15. Cleanliness is next to godliness.
16. Curiosity killed the cat.
17. Don't bite the hand that feeds you.
18. Don't count your chickens before they hatch.
19. Don't cry over spilled milk.
20. Don't put all your eggs in one basket.
21. Easy come, easy go.
22. Every cloud has a silver lining.
23. Every dog has its day.
24. Every man for himself.
25. Fortune favors the bold.
26. Haste makes waste.
27. Honesty is the best policy.
28. If the shoe fits, wear it.
29. If you can't beat them, join them.
30. Ignorance is bliss.
31. It's never too late to learn.
32. It's raining cats and dogs.
33. Kill two birds with one stone.
34. Let sleeping dogs lie.
35. Money doesn't grow on trees.

VAC-2 : AGRI. ENGINEERING
(ENVIRONMENTAL SCIENCE-2)

હેતુઓ:-

- વિદ્યાર્થીઓ પર્યાવરણ સંરક્ષણનું મહત્વ સમજે
- વિદ્યાર્થીઓ પ્રાકૃતિક સંપતિનું મહત્વ સમજી અને તેનો વિવેકપૂર્વક ઉપયોગ કરવાની સમજ કેળવે.
- વિદ્યાર્થીઓ પ્રદૂષણ વિષે ખ્યાલ મેળવે.
- વિદ્યાર્થીઓ પર્યાવરણના સામાજિક પ્રશ્નોથી માહિતગાર બને.

ક્ષમતાઓ:-

- વિદ્યાર્થીઓ પર્યાવરણના જુદા જુદા ઘટકો વિષે સમજાવી શકે.
- વિદ્યાર્થીઓ પર્યાવરણમાં જન જાગૃતિ કઈ રીતે કરી શકાય તે સમજાવી શકે.
- વિદ્યાર્થીઓ પર્યાવરણ માટેના જુદા જુદા ભીત સૂત્રો લખી શકે.
- વિદ્યાર્થીઓ પર્યાવરણના પ્રદૂષણો વિષે સમજાવી શકે.

Course Contents:

Unit No.	Syllabi	Teaching Hours
1	**પર્યાવરણીય પ્રદૂષણ, વ્યાખ્યા, પ્રકારો** 1. વાયુ પ્રદૂષણ, કારણો, અસર અટકાવવાના ઉપાયો 2. જળ પ્રદૂષણ, કારણો, અસર અટકાવવાના ઉપાયો 3. ધ્વનિ પ્રદૂષણ, કારણો, અસર અટકાવવાના ઉપાયો	15
2	**પર્યાવરણ અને સામાજિક પ્રશ્નો** 1. વસ્તી વધારો અને પર્યાવરણ શહેરીકરણ 2. શહેરીકરણ અને ઉર્જા 3. પર્યાવરણ અને આરોગ્ય, HIV/AIDS 4. સામાજિક વનીકરણ	15

Suggested Reading:

1. પર્યાવરણશાસ્ત્ર – બીપીનભાઈ જોશી
2. પર્યાવરણ અને ભૂકંપ ઈજનેરી – ડો.
3. જંગલોની મુલાકાત લઈ અભ્યાસ કરવો.
4. Ecology and Environmental – P. D. Sharma Rastogi

Evaluation Scheme and Distribution of Marks

Paper Style (For the Subject with Credit 2)

Ques. No.	Particulars	From which Unit	Marks
1	Questions (Any Two Out of Four)	1	10
2	Questions (Any Two Out of Four)	1	10
3	Questions (Any Two Out of Four)	From each Unit	05
Total Marks			**25**

Paper Style (For the Subject with Credit 4)
(Major/Minor/MDC Paper Evaluation Scheme and Distribution of marks)

EXTERNAL ASSESSMENT BY UNIVERSITY		
Que. No.	**Particulars**	**Marks**
Q-1	Questions from Unit-1 (Any Two out of Four)	10
Q-2	Questions from Unit-2 (Any Two out of Four)	10
Q-3	Questions from Unit-3 (Any Two out of Four)	10
Q-4	Questions from Unit-4 (Any Two out of Four)	10
Q-5	Questions from Unit-5 (Any Two out of Four)	10
Total Marks		**50**

College : Courses Offered

- B.Sc. – Bachelor of Science
  (Microbiology, Biotechnology, Biochemistry, Chemistry, Mathematic, Physics)
- B.Sc.(IT) – Bachelor of Science in Information Tech.
- B.C.A. – Bachelor of Computer Application
- D.M.L.T. – Diploma in Medical Laboratory Technology
- M.Sc.(IT) – Master of Science in Information Technology
- M.Sc.(Micro.) – Master of Science in Microbiology
- M.Sc.(Chem.) – Master of Science in Chemistry

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