UNIT : 1. Food microbiology 09 hrs

- Microbial flora of fresh foods.
- Microbial spoilage of food: role of microorganisms in food spoilage, spoilage of fresh and canned foods.
- Food poisoning: sources of contamination and introduction to food poisoning. Role of *Clostridium botulinum*, *Salmonella spp.*, *Staphylococcus aureus* and *Bacillus cereus* as food poisoning agents.
- Preservation of food: general principles, methods of preservation- Use of aseptic handling, high temperature, pasteurization, sterilization, canning, low temperature dehydration, osmotic pressure, developed and added preservatives, radiations.

UNIT : 2. Fermented food 08 hrs

- Introduction to Fermented Foods: Pickles, Sauerkraut, Bread
- Introduction to Indian fermented foods: Idli, Dhokla
- Microbes as food: Mushrooms, Spirulina and Yeasts

UNIT : 3 Dairy microbiology 08 hrs

- Microbiology of starter cultures
- Cheese: Types, curdling, processing, ripening
- Other fermented dairy products: Yogurt, cultured buttermilk, acidophilus milk, Kefir and cultured sour milk
- Introduction to probiotics, prebiotics and symbiotics
- Milk borne Pathogen (*Mycobacterium*, *Coxiella*)

UNIT : 4 The HACCP System and Food Safety 05 hrs

- HACCP, Hazard analysis of critical control point (HACCP) -Principles, flow diagrams, applications, limitations.
- Microbiological Criteria for Food Safety
  (a) Microbial standards for food
  (b) FDA, BIS, Food Safety and Standard Act of India
  (c) Food certification marks in India: ISI, Ag mark, FPO, BIS, FSSAI
REFERENCE BOOKS
6. Indian Standards: Food Hygiene-Microbiological Criteria-Principles for Establishment and Application
8. Internet and Pamphlet for BIS standards for common foods.
1. Microbiological analysis of food
   A. Standard plate count
   B. Determination of MPN of coliforms

2. Microbiological analysis of milk
   A. Standard plate count
   B. Determination of microbial load by use of MBRT and RRT of raw, boiled and pasteurized milk
   C. Detection of fecal coliforms
   D. Detection of Acid fast bacteria in milk

3. Alkaline phosphatase test to check the efficiency of pasteurization of milk.

4. Isolation of fungi from bread.
UNIT I. Air microbiology 08 hrs
- Air flora
  - i. Transient nature of air flora
  - ii. Droplet, droplet nuclei, and aerosols
- Air pollution: Chemical pollutants, their sources in air and effects on human health
- Methods of Air sampling and types of air samplers
  - A. Impact on solids
  - B. Impingement in liquid
  - C. Sedimentation
  - D. Centrifugation
  - E. Precipitation
  - F. Thermal Precipitation
- Air sanitation: Physical and chemical methods
- Air borne infections

UNIT 2. Water microbiology-i 08 hrs
- Types of water: surface, ground, stored, distilled, mineral and de-mineralized water
- Bacteriological standards of potable water, Bureau of Indian standards (BIS) World health Organization (WHO)
- Water borne diseases
- Indicators of faecal pollution;
  - i. Coliforms
  - ii. Streptococcus faecalis
  - iii. Clostridium perfringens

UNIT 3 Water microbiology-ii 07 hrs
1. Bacteriological analysis of Drinking Water
  - i. Presumptive coliform count
  - ii. Confirmed test
  - iii. Completed test
  - iv. Eijkman test
  - v. Membrane filter technique
2. Quantitative analysis of Drinking water: MPN, SPC

UNIT 4. Waste water microbiology 07 hrs
- Sewage and Waste Water
  - i. Physic chemical parameters: pH, temperature, total solids, Suspended solids, Chemical Oxygen Demand (C.O.D.)
  - ii. Biological parameters: B.O.D., Toxicity
• iii. Industrial water pollutants, their ecological effects and health hazards (Biomagnification and eutrophication)

1 Characteristics of waste water
• i. Physico chemical parameters: pH, temperature, total solids, Suspended solids, Chemical Oxygen Demand (C.O.D.)
• ii. Biological parameters: B.O.D, Toxicity
• iii. Industrial water pollutants, their ecological effects and health hazards (Biomagnification and eutrophication)

2 Methods of waste water treatment
• i. Primary treatment and secondary treatment: Principles and role of microorganisms in: Septic tank, Imhoff tank, trickling filters, activated sludge process and oxidation ponds
• ii. Advanced treatment and final treatment
• iii. Solid waste processing: Anaerobic sludge digestion and composting

REFERENCE BOOKS:
1. Microbiological analysis of drinking water
   A. Standard plate count
   B. Detection of fecal pollution of water by performing presumptive, confirmed and completed test
   C. Determination of MPN of coliforms in water

2. Study of skin flora

3. Study of Air flora by settling plate technique
Unit 1. Enzymes 07 hrs
- General introduction
- Physical and chemical properties
- Structure of enzymes: Prosthetic group, apoenzyme, coenzymes, cofactors
- Localization of enzymes: Extra cellular and intra cellular
- Nomenclature and classification of enzymes, IUB system of enzyme classification
- Enzyme action
- Active sites of enzymes
- Mechanism of enzyme action
- Factors affecting enzyme activity

Unit 2. Regulation of Enzymes 08 hrs
- Activation energy
- Michaelis- Menten equation,
- Irreversible and reversible inhibition: competitive and non-competitive inhibition.

Unit 3. Introduction to Metabolism 07 hrs
- Introduction to microbial metabolism
- Catabolism
- Anabolism
- Types of Metabolites
- Primary metabolism
- Secondary metabolism
- Intermediary metabolism
- Precursor metabolites
- Role of energy rich compounds and reducing power

**Unit 4. Membrane Transport** 08 hrs

- Introduction
- Structure of membrane
- Mechanism of Membrane transport
- Secondary active transport
  - a. symport
  - b. Antiport
  - c. uniport
- Phosphate bond linked active transport
- Group Translocation
  - a. Phosphotransferase system.
  - b. Acyl coA synthetase system.
  - c. Phosphoribosyl transferase
- Utilization of substrates that cannot enter the cell
Reference books:


1. Effect of pH on enzyme activity (4, 7, 9)

2. Effect of Temp. On enzyme activity (0°C, 15°C, 30°C, 45°C, 60°C)

3. Study of Biochemical reactions
Department of Microbiology
Semester-IV
(In Force from June-2017)
EC-401: Bio gas Technology
(Syllabus of theoretical portion)
(Total Teaching Hours=30, Credit=02)

Unit I. Bio gas 15 hrs
- Introduction: Definition, History of bio gas
- How bio gas is produced? (Biochemistry)
- Use of different raw materials for bio gas production
- Factor affecting the production of bio gas
- Qualitative (by Orset apparatus) and quantitative(by flow meter) analysis of bio gas production

Unit II Bio gas Plant 15 hrs
- Types of bio gas plant models (Design)
- How operate the bio gas plants?
- Maintenance of bio gas plants
- Uses of bio gas
- Lightning
- Cooking
- Vehicle fuel
- Electricity generation
- Utilization of digested slurry
- Economics of bio gas plant

References
**Board of Studies (Microbiology)**

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Unit-1: Heterocyclic compounds (20 Marks) (15 Hours)

1.1 Introduction (1 hour)
1.2 Nomenclature of heterocycles: (3 hours)
   - systematic nomenclature system for naming three to ten membered
     monocyclic heterocycles 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 (1 hour)
   1.4 Aromaticity and orbital structure of pyrrole, furan and thiophene (1 hour)
   1.5 Preparation of pyrrole, furan and thiophene (1 hour)
   1.6 Orientation of electrophilic substitution in pyrrole, furan and thiophene (1 hour)
   1.7 Relative reactivity toward electrophilic aromatic substitution in pyrrole, furan,
      thiophene and benzene (1 hour)

   Six membered heterocyclic compounds [Pyridine]

   1.8 Source of pyridine compound (1 hour)
   1.9 Aromaticity and orbital structure of pyridine (1 hour)
   1.10 Basicity of pyridine including comparison with basicity of pyrrole and
        aliphatic amine (1 hour)
   1.11 Orientation of electrophilic and nucleophilic substitution in pyridine
        (2 hours)
   1.12 Relative reactivity toward electrophilic aromatic substitution in benzene,
        pyridine (1 hour)

References

1. Organic Chemistry (sixth edition), Robert Thornton Morrison and Robert Neilson
   New Jersey (1998)
Unit-2: Carbohydrates-I (50% Marks) (15 Hours)

2.1 Definition and classification (0.5 hour)
2.2 Nomenclature (0.5 hour)
2.3 D and L notation (0.5 hour)
2.4 Configuration of aldose and ketose containing three through six carbon atoms (2 hours)
2.5 General properties of monosaccharide (Glucose and Fructose): colour, taste, physical state, solubility (0.5 hour)
2.6 Chemical properties of monosaccharide (Glucose and Fructose): acetylation, oxidation, reduction, cyanohydrin formation, oxime formation, osazone formation (2.5 hours)
2.7 Epimers, epimers of D-glucose, conversion of an aldohexose into its C-2 epimer (manno)se (1 hour)
2.8 Methods of interconversion of sugars (2 hours)
   - 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 Configuration of (+) glucose: The Fischer proof (2 hours)
2.10 Cyclic structure of glucose (2 hours)
2.11 Structure of disaccharides (sucrose, cellobiose, maltose, lactose) and polysaccharides (starch and cellulose) excluding their structure elucidation (1.5 hour)

References

Board of Studies(Chemistry)

(1) Dr. Nikhil Bhatt
(2) Dr. Pranav Shrivastav
(3) Dr. Dasharath P. Patel
(4) Dr. Yogesh S. Patel
(5) Dr. Mallika Sanyal
(6) Dr. Hitesh J. Shah
(7) Dr. Mayur C. Shah
(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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GUJARATVIDYAPEETH : AHMEDABAD  
M.D. GramsevaMahavidyalaya, Sadra, Dist: Gandhinagar  
Department of Microbiology  
B.Sc. Semester-IV  
CHEM-402: Analytical Chemistry  
(Syllabus of theoretical portion) (In force from December, 2017)  
(External Evaluation: 60% + Internal Evaluation: 40%)  
(Total Teaching Hours=30, Credit=02)  

Unit-1: Introduction to separation techniques (50% Marks) (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  

Unit-2: Gravimetric analysis and precipitation equilibrium (50% Marks) (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)  
2.3 Gravimetric 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

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(7) Dr. Mayur C. Shah
(A) Separation techniques (21 Hours)
(1) Crystallization (6 hours)
   - Concept of induction of crystallization
   - Phthalic acid from hot water
   - Acetanilide from boiling water
   - Benzoic acid from water
   - Naphthalene from ethanol
(2) Distillation (6 hours)
   - 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) (9 hours)
   - 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 iron oxide
(2) Ni as Ni (DMG)$_2$
(3) Ba as BaSO$_4$
(4) Al as Al$_2$O$_3$

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Proposed Syllabus for Bachelor of Science (B.Sc)  
Core Paper – English

Semester 4: ENG 401: English

Credit: 2  
Number of Hours per Semester: 30

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 (Weightage – 40%)  
8 Hours

1. A Letter to Indira on her Birthday by Jawaharlal Nehru
2. An Irresistible Fund Raiser by Louis Fischer
3. It Takes a Thief by Arthur Miller
4. Thirst by Bibhuti Bhushan Bandopadhyay

Comprehension Pattern:
1. Short questions
2. Short descriptive questions
3. Short notes
4. Fill in the blanks
5. Multiple choice questions based on the text

NB: 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.
Unit 2: Vocabulary (Weightage – 10%) 2 Hours
1. Antonyms/Synonyms (Based on the text)
2. Use of Scientific Vocabulary and Phrases
3. Linking words

Unit 3: Grammar (Weightage – 10%) 4 Hours
1. Passive Voice

NB: This unit should use scientific writing such as journal writings to explain the importance and function of Passive Voice.

Unit 4: Writing Skills (Weightage – 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 5: Academic Skills: Reading Skills (Weightage – 10%) 5 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.

Seminar/Presentation 5 Hours

List of Reference Books:
