# GUJARAT TECHNOLOGICAL UNIVERSITY

## FOOD PROCESSING & TECHNOLOGY (14)

FOOD & INDUSTRIAL MICROBIOLOGY

**SUBJECT CODE**: 2141402

B.E. 4th SEMESTER

**Type of course**: Food Processing Technology

**Prerequisite:** Nil

**Rationale:**

1. Food and industrial microbiology is the study of the microorganisms that play pivotal role in preparation of foods at small and large scale.
2. It includes the propagation and preservation of microorganisms at large scale
3. In addition, concept of use of high & low temperature, chemicals and radiation for improvement of shelf life of food is essential part of this subject.
4. Another indispensable aspect of food and industrial microbiology is screening of microorganisms for desirable characteristic essential at industrial level (example: metabolite, and enzyme production), separation and purification of particular bio-substance using chromatography, blotting, centrifugation, precipitation etc

**Teaching and Examination Scheme:**

| Teaching Scheme | | | Credits | Examination Marks | | | | | | Total Marks |
|---|---|---|---|---|---|---|---|---|---|---|
| L | T | P | C | Theory Marks | | | Practical Marks | | | |
| | | | | ESE (E) | PA (M) | | ESE (V) | | PA (I) | |
| | | | | | PA | ALA | ESE | OEP | | |
| 3 | 0 | 2 | 5 | 70 | 20 | 10 | 20 | 10 | 20 | 150 |

**Content:**

| Sr. No. | Topics | Teaching Hrs. | Module Weightage |
|---|---|---|---|
| **1** | **Role of microorganisms in spoilage of vegetables and fruit juices:** Microbiology of Fruits and Vegetables, Fruit juices, Beverages and Carbonated drinks: Sources, incidence and types of microbes, microbial spoilage and methods of control | **2** | **7** |
| **2** | **Role of microorganisms in spoilage of dairy products:** Microbiology of Milk and Milk Products: Normal and abnormal flora of milk, sources of contamination, pasteurization of milk and defects in milk and milk products. | **3** | **7** |
| **3** | **Role of microorganisms in spoilage of cereals:** Microbiology of Cereals and Cereal products: Microbiology of Cereal grains and meals, flour, dough products, cakes and other bakery products. | **3** | **8** |
| **4** | **Role of microorganisms in spoilage of canned foods:** Microbiology of Canned Foods Causes of spoilage, types of aerobic and anaerobic microbial spoilage. | **3** | **8** |
| **5** | **Prevention of microbial food spoilage by chemicals and radiation:** Food Preservation by use of Chemicals and Radiation: Types of chemical preservatives, mode of action and industrial applications. | **2** | **4** |
| 6 | **Prevention of microbial food spoilage by use of high and low temperature:** Food Preservation by use of Low Temperature, High temperature and Drying: Types of low temperature preservation | **3** | **10** |

| | | | |
|---|---|---|---|
| | methods, mode of action on microbes, Various methods of high temperature preservation, D, F Values, 12D concept. Determination of D value and Z value from graphs. | | |
| 7 | **Foodborne diseases:** Food Borne Diseases and Food Poisoning: Food borne pathogens, Food infections and Food Intoxications. Mechanism of toxin (endotoxin and AB type) action | **4** | **8** |
| 8 | **Isolation and Screening of microorganisms:** Isolation and Screening. Isolation techniques, screening methods for industrial applications (Exopolysaccharide, amylase and beta-galactosidase). | **2** | **6** |
| 9 | **Strain improvement and preservation:** Improvement and Preservation of Industrial cultures: Importance, development of strains, Preservation methods. | **2** | **10** |
| 10 | **Fermenter:** Industrial Fermenter: Important parts and their functions and types of fermenter. Sterilization of medium. Batch, fed batch and continuous fermentation. | **4** | **10** |
| 11 | **Recovery and purification of microbial metabolite:** Recovery and Purification: Procedure and techniques for recovery and purification of fermentation productsbased on their size, polarity, solubility, and binding. 1-D and 2-D electrophoresis. | **5** | **9** |
| 12 | **Microbial growth kinetics:** Introduction to microbial growth kinetics and inoculum preparation. | **3** | **5** |
| 13 | **Metabolite and biomass production:** Metabolite and Biomass production: Production details of Ethyl Alcohol, Citric acid, Single Cell Protein, Brewers and Bakers Yeasts | **3** | **8** |

**Suggested Specification table with Marks (Theory):**

| **Distribution of Theory Marks** | | | | |
|---|---|---|---|---|
| R Level | U Level | A Level | N Level | E Level |
| 18% | 19% | 22% | 22% | 19% |

**Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate and above Levels (Revised Bloom's Taxonomy)**

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table

**Reference Books:**


1. Modern Food Microbiology, James M. Jay, CBS Publishers & Distributors, Delhi.
2. Food Microbiology, W C Frazier and D C Westhoff, McGraw Hill Book Company,
3. NY.
4. Industrial Microbiology, S C Prescott and C G Dunn, McGraw Hill Book Co.
5. Industrial Microbiology, A H Patel Mac Millan Press


**Course Outcomes:**

After successful completion of the course students should be able to:

1. Understand the role of microorganisms in reducing shelf life of foods
2. Understand and optimize the storage and processing treatment of foods to reduce the microbial load
3. Mechanism and types of foodborne diseases
4. Isolate and screen microorganism with potential to produce particular metabolite
5. Enhance the efficiency of microorganisms to produce particular metabolite and produce the same at largescale.
6. Processes involved in production of microbial metabolite

**List of Practicals:**

1. To determine quality of milk by methylene blue reduction test
2. Microbiological examination of foods
3. Preparation of Sauerkraut
4. Sterilization of microbial growth media using different methods
5. To identify the fungal contamination in given food sample
6. To study the sugar utilization patterns by microorganisms
7. To determine starch hydrolytic activity of microorganisms
8. To determine β-galactosidase activity of microorganisms
9. To determine thermal death point of microorganisms
10. To determine thermal death time of microorganisms

**Open Ended Problems:**

The topics taught in this subject would be useful to develop insight and application based knowledge among students. For instance, the student might be able to develop an experimental setup to:

Screen microorganisms for their potential to produce an enzyme example β-galactosidase. What procedure should be adopted to specifically purify this enzyme? After selecting the isolate, prepare a large scale inoculum to develop a fermented dairy product for lactose intolerant people

**Major Equipments**

1. Laminar air flow cabinet
2. Autoclave
3. Microscope
4. Colony counter
5. Biological /BOD incubator
6. Refrigerator

**List of Open Source Software/learning website:**

a. http://highered.mcgraw-hill.com/sites/0072556781/student_view0/chapter12/animation_quiz_4.html
b. http://bio-alive.com/animations/biology.htm
c. http://www.bluffton.edu/courses/TLC/MontelA/Montel/Alternative_Energy_Website/biomass.htm

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**ACTIVE LEARNING ASSIGNMENTS**: Preparation of power-point slides, which include videos, animations, pictures, graphics for better understanding theory and practical work – The faculty will allocate chapters/ parts of chapters to groups of students so that the entire syllabus to be covered. The power-point slides should be put up on the web-site of the College/ Institute, along with the names of the students of the group, the name of the faculty, Department and College on the first slide. The best three works should submit to GTU.