Department of Microbiology (M.Sc.I)

1. TITLE: Entrepreneurship in Microbiology
2. YEAR OF IMPLEMENTATION: 2018
3. PREAMBLE:

This syllabus is framed to give sound knowledge with understanding of entrepreneurship in Microbiology to post-graduate students at first year of two years of certificate course.

The goal of the syllabus is to make setting up an industry related to Microbiology popular, interesting and encouraging to the students. Also this course will help students to be a good employee to various microbiological industries.

The new and updated syllabus is based on a basic and applied approach with vigour and depth. At the same time, precaution is taken to make the syllabus as per the needs of industries.

The syllabus is prepared after discussion at length with number of faculty members of the subject and experts from industries and alumni working in pharmaceutical, food, dairy and agriculture industries.

The units of the syllabus are well defined, taking into consideration the level and capacity of students.

4. GENERAL OBJECTIVES OF THE COURSE:

1. This course guides such students of Microbiology which are willing to start their own small scale industry.
2. Even those students which will be placed in various Microbiology, Biotechnology related industries will get benefits from this course.
3. This course not only gives knowledge of various industrial processes but also more importantly guides our students about basic essentials of industrialization.
4. This course offers understanding of all aspects of entrepreneurship in Microbiology.

5. DURATION: One Year
6. PATTERN: Annual
7. MEDIUM OF INSTRUCTION: English
8. STRUCTURE OF COURSE:

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<td>C MiT101: Essentials of Food &amp; beverages industry</td>
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A) LIBRARY:

Reference and Textbooks, Journals and Periodicals, Reference Books for Advanced Books for Advanced studies. –List Attached

B) SPECIFIC EQUIPMENTS: Computer, LCD, Projector, Visualizer, Smart board

C) Laboratory Equipments:
   1. Laminar Air Flow
   2. Fermentor
   3. Light Microscope
   4. Autoclave

   Theory: Paper I: CMiL101: Essentials of Food & beverages industry

Learning Objectives:

1. Students should learn basic knowledge of dairy industry.
2. Students should understand essentials of wine and related beverages production.
3. Students should get information regarding fruit processing.
4. Students should know basics of water processing industry.
Unit 1: Essentials of Dairy & Wine industry (12)

1. Milk and milk products-
   a) Definition, composition, factor affecting composition,
   b) Nutritive value of milk
   c) Uses of milk and fermented milk products
   d) Production of various milk products like curd, flavoured milk, etc...

2. Wine making-
   a) Classification of wine on the basis of chemical constituents-
   b) Production of white wine
   c) Production of red wine
   d) Production of fortified wine

Unit 2: Essentials of Fruits, vegetable processing and water and aerated drink industry (12)

A) Fruit and vegetable processing:
   I) Status and scope of fruits and vegetable industry in India, Composition and nutritive value of fruits and vegetables, Importance of fruit and vegetable in the diet
   II) Different types of spoilages in fruits and vegetables, general methods of preservation of whole fruits/vegetables and processed fruits and vegetables
   III) Food additives- use of food additives in processing of fruits and vegetables
   IV) Definition of preservatives, types of preservative used in fruit and vegetable processing.
   V) Fruit beverages- squashes, syrup and crushes etc.
   VI) Importance of personal hygiene cleaning and sanitary standards in fruit and vegetable processing industry

B) Water and Aerated drinks industry
   I) Introduction of water and aerated drink products
   II) Drinking water production from surface water a) Prefiltration b) addition of chemicals c) natural filtration d) disinfection e) fine filtration f) preservation and storage.
   III) Drinking water standards- WHO’s drinking water standards.
   IV) Fruit and juice based drinks: Ingredients, additives and flavoring-Ingredients and additives of soft drink—sweetens, acids, preservatives and colours. Flavoring- flavoring raw materials and substances, developing and processing of flavoring.

Unit 3: Essentials of pharmaceutical industry - I (12)

A) Principles & practice of Sterilization
   a. Sensitivity of microorganisms: Survivor curves, D-value, Z-value

B) Formulations
   a. Sterile Pharmaceutical products: Injections,
   b. Non-injectable sterile fluids,
   c. Ophthalmic preparations

C) Quality control
   a. Introduction, control of microbial contamination during manufacture- general aspects
   b. Sterilization control & sterility assurance – Bioburden determinants, Environmental monitors, Sterilization monitors, Sterility testing.

Unit 4: Essentials of pharmaceutical industry - II (12)

A) Production
   a. Manufacture of sterile products- Clean & aseptic areas- general requirements, Design of premises, internal surfaces, services, air supply, clothing, etc.
   c. Mammalian cell culture for biopharmaceutical production – Overview, construction & selection of high-producing cell lines, medium development, process development, scale-up & scale-down.
B) GMP
   b. GMP manufacturing of biopharmaceuticals- Characteristics of desired manufacturing processes, process validation, raw materials for GMP manufacturing, operation & release, production cost.

**Recommended Books: (Unit wise)**

1. UNIT 1: Dairy Microbiology by H. A. Modi
   Outline of Dairy Technology by Sukumar De
   Industrial Microbiology by Casida
   Milk & Milk products by Charence
2. UNIT 2: Food Microbiology by Admas & Moss
   Manual of Industrial Microbiology & Biotechnology – Edited by Baltz, Demain, Davies
3. UNIT 3: Industrial Microbiology by Casida
   Pharmaceutical Microbiology – 6th edition by Hugo & Russell
4. UNIT 4: Industrial Microbiology by Casida
   Pharmaceutical Microbiology – 6th edition by Hugo & Russell

**Learning Outcomes per unit**

1. UNIT 1: Students should get thorough knowledge of various processes of dairy industry.
2. UNIT 2: Students should know about basics of setting up a winery.
3. UNIT 3: Students should understand essentials of fruit and vegetables processing.
4. UNIT 4: Students should learn basic processes regarding water processing and soft drinks production.

**CMiL102: Practical Course: (for 24 practical) 96 periods**

1. Platform tests for milk sample
2. Phosphatase test for milk sample
3. Microbiological assay of amino acid/vitamins in fermented milk sample
4. Wine production from different sources
5. Estimation of yeast and molds in alcohol beverages
6. Microbial profiling of wine
7. Direct microscopic count in tomato puree/sauce/paste
8. Determination of aciduric spore former in canned food
9. Detection of fruit surface disinfection quality by using different disinfectants
10. Detection of quality of drinking water using MPN test
11. Detection of saccharophilic microorganisms in soft drinks.
12. Determination of mineral content in packaged water
13. Qualitative analysis of media before use
14. Microbial limit test of pharmaceutical product
15. Endotoxin testing of pharmaceutical product
16. Environmental monitoring
17. Antibiotic susceptibility testing
18. Microbial testing of non-sterile product
19. Calibration of instruments used in pharmaceutical industry
20. Phenol coefficient test
21. Preparation animal cell culture medium
22. Ames test for detection of carcinogenicity
23. MIC of sulfa drug
24. In-use dilution test for disinfectant
Learning outcomes for each practical
Students should learn:
1. Various primary tests of raw milk collected in dairy and tests used to detect efficiency of pasteurization.
2. Tests to measure nutritional quality of fermented milk products.
3. How to produce wine from different sources and measure its microbiological quality.
4. Various tests to detect microbiological quality of final product of food industry.
5. To produce good quality packaged water and other aerated soft drinks.
6. About various sterility and cleaning aspects required to maintain in pharmaceutical industries.
7. How to prepare media and other requirements of tissue culture technology.
8. Final quality testings of pharmaceutical product as per FDA or other governmental institutes.

Recommended Books:
2. Laboratory fundamentals of Microbiology by Jeffrey C. Pommerville

CMiP103: Project course: for 24 periods and 2 credits