

# CHEM2013: MICROBIOLOGY

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## Effective Term

Semester A 2022/23

## Part I Course Overview

### Course Title

Microbiology

### Subject Code

CHEM - Chemistry

### Course Number

2013

### Academic Unit

Chemistry (CHEM)

### College/School

College of Science (SI)

### Course Duration

One Semester

### Credit Units

3

### Level

B1, B2, B3, B4 - Bachelor's Degree

### Medium of Instruction

English

### Medium of Assessment

English

### Prerequisites

CHEM1200/BCH1200 Discovery in Biology (for normative 4-year students) or A Level Biology (for advance standing I students)

### Precursors

Nil

### Equivalent Courses

BCH2013 Microbiology

### Exclusive Courses

Nil

## Part II Course Details

### Abstract

This course aims to:

- provide a broad introduction to the diversity of microorganisms including archaea, bacteria, fungi, protists and viruses and what they do in the world at large, in soils, air and waters, in the human body, and in animals and plants;
- develop students' discovery attitude about microbes, skills at searching for and presenting information related to microbiology in clear and concise English;
- develop student skills to apply a problem-based learning approach to study microbiology events in our daily lives.

### Course Intended Learning Outcomes (CILOs)

CILOs		Weighting (if DEC-A1 DEC-A2 DEC-A3 app.)			
1	Identify and describe the diversity of archaea, bacteria, fungi, protists, viruses and their habitats and analyze the environmental factors that affect their growth.		x		
2	Identify and discuss the importance of microorganisms in both industry and public health.			x	x
3	Discover the different roles of microbes in our daily lives and apply basic microbiology concepts to solve daily problems related to microbiology issues.				x
4	Describe the roles of microbial secondary metabolism and explain how secondary metabolites are synthesized.		x	x	
5	Describe, compare and contrast the different agents and methods for control of microbial growth used in vitro and in humans.		x		
6	Gather and appraise information relating to microbiology, analyze and identify important messages from such information and present them in clear and concise English.			x	

#### A1: Attitude

Develop an attitude of discovery/innovation/creativity, as demonstrated by students possessing a strong sense of curiosity, asking questions actively, challenging assumptions or engaging in inquiry together with teachers.

#### A2: Ability

Develop the ability/skill needed to discover/innovate/create, as demonstrated by students possessing critical thinking skills to assess ideas, acquiring research skills, synthesizing knowledge across disciplines or applying academic knowledge to real-life problems.

#### A3: Accomplishments

Demonstrate accomplishment of discovery/innovation/creativity through producing /constructing creative works/new artefacts, effective solutions to real-life problems or new processes.

**Teaching and Learning Activities (TLAs)**

TLAs	Brief Description	CILO No.	Hours/week (if applicable)
1	Lectures and tutorials	Teaching and learning will be primarily based on interactive lectures and tutorials with activities designed to develop the discovery attitude in relation to microbes' role in our daily lives, along with complementary in-class and on-line discussions where students will be able to be involved in small group sharing, so they can learn to describe and discuss the related subject matters.	1, 2, 3, 4
2	“Ask a Question” exercise, written assignments and scientific journal article review	Appropriate “Ask a Question” exercise, written assignments, scientific journal article review will be implemented for the students to develop their appraisal, analytical and oral and written communication skills.	4, 5
3	Problem-based learning activities and oral presentations	Problem-based learning activities and oral presentations will be organised for the students to practise their skills in identification of learning issues, analysis and synthesis of collected information, application of synthesised information to solve problems and presentation.	5, 6

**Assessment Tasks / Activities (ATs)**

ATs	CILO No.	Weighting (%)	Remarks (e.g. Parameter for GenAI use)
1	Tests	1, 2, 3, 4	5
2	Written assignments, scientific journal article review	1, 2, 3, 4, 5	10

3	PBL contribution, including oral presentations	6	15	
4	“Ask a Question” activity, in-class and online discussions, including discovery activities	1, 2, 3, 4, 5	15	

**Continuous Assessment (%)**

45

**Examination (%)**

55

**Examination Duration (Hours)**

3

**Additional Information for ATs**

Starting from Semester A, 2015-16, students must satisfy the following minimum passing requirement for courses offered by CHEM:

“A minimum of 40% in both coursework and examination components.”

**Assessment Rubrics (AR)****Assessment Task**

Tests

**Criterion**

To verify the stat of students’ learning progress

**Excellent (A+, A, A-)**

High

**Good (B+, B, B-)**

Significant

**Fair (C+, C, C-)**

Moderate

**Marginal (D)**

Basic

**Failure (F)**

Not even reaching marginal levels

**Assessment Task**

Written assignments, scientific journal article review

**Criterion**

Encourage students to think critically by allowing them to review and criticize the current scientific article

**Excellent (A+, A, A-)**

High

**Good (B+, B, B-)**

Significant

**Fair (C+, C, C-)**

Moderate

**Marginal (D)**

Basic

**Failure (F)**

Not even reaching marginal levels

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**Assessment Task**

PBL contribution, including oral presentations

**Criterion**

To challenge students to collaborate communicate and working together to solve problem as a team

**Excellent (A+, A, A-)**

High

**Good (B+, B, B-)**

Significant

**Fair (C+, C, C-)**

Moderate

**Marginal (D)**

Basic

**Failure (F)**

Not even reaching marginal levels

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**Assessment Task**

“Ask a Question” activity, in-class and online discussions, including discovery activities

**Criterion**

Ability to understand the materials in lectures and asking questions from critical thinking

**Excellent (A+, A, A-)**

High

**Good (B+, B, B-)**

Significant

**Fair (C+, C, C-)**

Moderate

**Marginal (D)**

Basic

**Failure (F)**

Not even reaching marginal levels

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**Assessment Task**

Examination

**Criterion**

To test students' application of material taught in class and evaluate their performance

**Excellent (A+, A, A-)**

High

**Good (B+, B, B-)**

Significant

**Fair (C+, C, C-)**

Moderate

**Marginal (D)**

Basic

**Failure (F)**

Not even reaching marginal levels

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## Part III Other Information

### Keyword Syllabus

- 1) Microbial diversity of archaea, bacteria, fungi, protists, viruses
  - physiological diversity (chemoorganotroph, chemolithotroph, phototroph, heterotroph, autotroph)
  - microbial systematics (phenotypic, genotypic, phylogenetic analysis)
- 2) Microbial growth
  - exponential growth
  - measuring microbial growth
  - environmental factors affecting growth
- 3) Microbial ecology
  - methods in microbial ecology (isolation, T-RFLP, DGGE)
  - how microbes interact with each other
  - descriptions of major microbial habitats
  - biofilms
- 4) Industrial microorganisms and products for the health and food industry
- 5) Microbial interactions with humans
  - normal microbial flora
  - microbial diseases (airborne, vectorborne, waterborne, foodborne, direct contact transmitted)
- 6) Microbial growth control
  - physical antimicrobial control
  - chemical antimicrobial control
  - antimicrobial drugs, in particular antibiotics and their mode of action
- 7) Microbial secondary metabolism and secondary metabolites

- polyketides and acetate pathways
- terpenoids and mevalonate and methylerythritol phosphate (MEP) pathways
- peptide biosynthesis

### Reading List

#### Compulsory Readings

Title	
1	Nil

#### Additional Readings

Title	
1	Fungal Biology, J.W. Deacon (Blackwell Publishing Limited, 2006)
2	Brock Biology of Microorganisms, Michael T. Madigan, John M. Martinko, David Stahl and David P. Clark (13th ed., Benjamin Cummings, 2010)
3	Medicinal Natural Products: A Biosynthetic Approach; Paul M. Dewick (John Wiley & Sons, Ltd, 3rd Edition). The electronic version of the textbook is available from the CityU Library: <a href="https://onlinelibrary.wiley.com/doi/book/10.1002/9780470742761">https://onlinelibrary.wiley.com/doi/book/10.1002/9780470742761</a>