# Course Specification

## Section 1 General Information

**1. Course Code and Title**

| | |
|---|---|
| In Thai | ICBI 214 จุลชีววิทยาทั่วไป |
| In English | ICBI 214 General Microbiology |

**2. Number of Credits** 4 (4-0-8)

4 (Theory 4 hrs, Practice 0 hrs, Self-Study 8 hrs./week)

**3. Curriculum and Course Type**

| | |
|---|---|
| 3.1 Program | Undergraduate |
| 3.2 Course Type | Specific Course √ Compulsory Course ☐ Elective Course |

**4. Course Coordinator and Instructor**

| | |
|---|---|
| 4.1 Course Responsible Instructor | Asst. Prof. Tumnoon Charaslertrangsi, Ph.D. |
| 4.2 Instructors | Asst. Prof. Tumnoon Charaslertrangsi, Ph.D.<br>Mahidol University International College<br>999 Phutthamonthon Sai 4 Road<br>Salaya Phutthamonthon<br>Nakhon Pathom 73170<br>+66-2-700-5000 ext 3550<br>Tumnoon.cha@mahidol.ac.th (.edu) |

**5. Semester/Class Level**

| | |
|---|---|
| 5.1 Semester | T.1/2024-2025 |
| 5.2 Number of Students Allowed | 45 Students |

**6. Prerequisites** ICBI 121 Biology I

**7. Co-requisites** ICBI 271 General Microbiology Laboratory

## Section 2 Course Goals and Course Description

### 1. Course Goals

This course aims to introduce the learners to the microbial world, ranging from structure and function to diversity and impact of microorganisms. The course hopes to broaden the perspective of the life that we can't see.

### 2. Course Description

(In Thai) โครงสร้าง สรีรวิทยา และนิเวศ์วิทยาของไวรัส แบคทีเรีย โปโตซัว และ รา ความสำคัญของจุลินทรีย์ต่อสุขภาพ สุขอนามัย การกระบวนการผลิตและอุตสาหกรรมอาหาร

(In English) Structure, physiology, and ecology of viruses, bacteria, protozoa, and fungi, especially bacteria, aspects of microbiology's importance in health, sanitation, food processing, and industry

## Section 3 Course Objectives, Course-level Learning Outcomes and Course Implementation

### 1. Course Objectives

Students comprehend essential microbial, structure and function, metabolism and metabolic pathways, information flow and genetics, microbial systems, diversity and evolution, and the impact of micro-organisms.

- Discuss the cells, organelles (e.g., mitochondria and chloroplasts) and all major metabolic pathways of microorganisms
- Explain the unique metabolic requirement of the microorganisms
- Highlight the role of gene transfer in microbiology
- Discuss different situations where microorganisms play unique roles
- Prepare the students to undertake senior project research by writing a literature review

### 2. Course-level Learning Outcomes: CLOs

On completion of the course, successful students will be able to:

CLO1 Describe the biology of microorganisms (e.g., viruses, bacteria, protozoa, helminths, and fungi), including cell structure and function, growth and division, energy and metabolism, metabolic pathways, microbial evolution and genetics, and information flow within a cell through written assignments and assessments

CLO2 Compare and contrast microbial diversity, interactions, microbial ecology, and impact of microorganisms in various environments/habitats using discussion and comprehension of case studies

CLO3 Analyze the roles of microbes in the contexts of health, sanitation, food processing, and industry by writing a term paper

CLO4 Effective written communication in microbiology (i.e., write a literature review)

**3. How to organize learning experiences to develop the knowledge or skills stated in number 2 and how to measure the learning outcomes**

| CLOs | Teaching and learning experience management | | | | | Learning outcomes measurements | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Lecture | Case studies | Term paper | Group presentation | Discussion forum | In-class assignments | Term paper | Quiz | Mid-term exam | Final exam |
| CLO1 | X | X | | X | | √ | | √ | √ | √ |
| CLO2 | X | X | | X | | √ | | | √ | √ |
| CLO3 | X | X | | X | X | √ | | | √ | √ |
| CLO4 | | | X | | | | √ | | | |

## Section 4 Lesson Plan and Evaluation

### 1. Lesson Plan

| Teaching Period | Topics/Details | Number of hours | | Methods: Teaching, Media | Lecturer |
|---|---|---|---|---|---|
| | | Theory | Practice | | |
| 1 | Course outline and expectation; Historical perspective | 3 | | Course introduction; lectures and discussion | TC |
| | Microscopy | 1 | | Lectures, discussion, formative assessment | TC |
| 2 | Bacterial cell structure and function | 2 | | Lectures, discussion, formative assessment | TC |
| | Bacterial cell structure and function, Archaeal and eukaryotic cell structure and function | 2 | | Lectures, discussion | TC |
| 3 | Viruses and other acellular infectious agents; | 2 | | Lectures, discussion, case study, formative assessment | TC |
| | Microbial growth; Growth curve | 2 | | Quiz, Lectures, discussion, case study, recitation and discussion | TC |
| 4 | Culture media and requirements, quorum sensing and biofilm | 2 | | Lectures, discussion, case study | TC |
| | Control of microorganisms in the environment | 2 | | Lectures, discussion, case study | TC |
| 5 | Microbial metabolism; Microbial catabolism | 3 | | Lectures, discussion, case study | TC |
| | Anabolism | 1 | | Lectures, discussion, case study | TC |
| 6 | Microbial genome and replication; Microbial genetics | 2 | | Lectures, discussion, case study | TC |
| | Review | 2 | | Review | TC |

| Teaching Period | Topics/Details | Number of hours | | Methods: Teaching, Media | Lecturer |
|---|---|---|---|---|---|
| | | Theory | Practice | | |
| 7 | Mid-term assessment | 2 | | Mid-term assessment | TC |
| | Biogeochemical cycling | 2 | | Lectures, discussion, case study | TC |
| 8 | Marine and freshwater ecosystem, Terrestrial Ecosystem; | 2 | | Lectures, discussion, case study | TC |
| | Microbial ecology and interaction; Archaea | 2 | | Lectures, discussion, case study | TC |
| 9 | Bacterial diversity | 3 | | Lectures, discussion, case study | TC |
| | Protists | 1 | | Lectures, discussion, case study | TC |
| 10 | Fungi; Viruses | 2 | | Lectures, discussion, case study | TC |
| | Innate immunity | 2 | | Lectures, discussion, case study | TC |
| 11 | Adaptive immunity | 2 | | Lectures, discussion, case study | TC |
| | Microbial pathogenicity | 2 | | Lectures, discussion, case study | TC |
| 12 | Helminths | 2 | | Lectures, discussion, case study | TC |
| | Industrial applications | 2 | | Lectures, discussion, case study | TC |
| | **Total hours of the entire trimester** | **48** | | | |

**Week 1**

| Week | CLO | Learning outcomes | Time | Learning activities | Assessment |
|---|---|---|---|---|---|
| 1.1 | | Meet and greet | 10 min | Introduction | Clicker questions |
| | | Course introduction and expectation | 50 min | Lectures and discussion | |
| | CLO1 | Able to describe different types of biological entities, domains of life, and beneficial and harmful microorganisms | 2 hr | Lectures and discussion | |
| | CLO1 | Able to describe the significant contribution of Louis Pasteur and Robert Koch in microbiology | | | |
| | CLO4 | Understand how to approach writing a scientific literature review | | | |
| 1.2 | CLO1 | Able to describe the different types of microscopes | 1 hr | Lecture and discussion | Recitation questions |
| | CLO1 | Able to describe the role of fixation and staining in visualizing microbes | | | |

**Week 2**

| Week | CLO | Learning outcomes | Time | Learning activities | Assessment |
|---|---|---|---|---|---|
| 2.1 | CLO1 | Able to describe basic structure and function of bacterial cells, particularly the cell envelop, inside and out of the cell | 3 hr | Lectures and discussion | Clicker questions |
| 2.2 | CLO2 | Able to distinguish between archaeal, bacterial, and eukaryotic cells | 1 hr | Lecture and discussion | Recitation questions |

**Week 3**

| Week | CLO | Learning outcomes | Time | Learning activities | Assessment |
|---|---|---|---|---|---|
| 3.1 | CLO1 | Able to describe the structure and function of viral particles. | 2 hr | Lectures and discussion | Clicker questions |
| | CLO1 | Able to describe the steps in one-step life cycle, lytic and lysogenic life cycle of viruses | | Group assignment | Assignment 2: Study Q |

| | | | | | |
|---|---|---|---|---|---|
| | CLO1<br><br>CLO3<br><br>CLO4 | Able to describe the enumeration and cultivations of viruses<br>Engage in group learning that leads to collaborative learning and case analysis<br>Accessing scientific databases | | | |
| 3.2 | CLO1<br><br>CLO1<br><br>CLO4 | Able to describe factors affecting microbial growth<br>Able to describe different phases of microbial growth<br>Structuring the literature review | 2 h | Lecture and discussion<br>Case studies | Clicker questions<br>Recitation questions |

**Week 4**

| Week | CLO | Learning outcomes | Time | Learning activities | Assessment |
|---|---|---|---|---|---|
| 4.1 | CLO1<br><br>CLO1<br><br><br>CLO4 | Able to calculate the double time and growth rate<br>Able to describe different physical form, composition, and function of culture medium<br>Term paper topic sharing discussion | 1 hr<br><br>1 hr | Group work on microbial growth calculation<br>Lectures and discussion | Assignment 3: Microbial growth<br>Case analysis submission<br>Recitation questions |
| 4.2 | CLO3 | Able to describe the advantages and disadvantage of different control methods in microbiology | 2 hr | Lecture and discussion | Recitation questions |

**Week 5**

| Week | CLO | Learning outcomes | Time | Learning activities | Assessment |
|---|---|---|---|---|---|
| 5.1 | CLO1,2<br><br><br>CLO1,2 | Able to distinguish between aerobic respiration, anaerobic respiration, and fermentation<br>Able to describe the diversity of microbial catabolism | 2 hr | Lectures and discussion<br>Case study | Clicker questions<br>Recitation questions |

| | | | | | |
|---|---|---|---|---|---|
| 5.2 | CLO3<br><br>CLO2 | Able to apply the microbial diversity in environmental contexts<br>Able to describe the importance of anabolism in microbial growth context | 2 hr | Lecture and discussion | Assignment 4: Modes of Nutrition<br>Recitation questions |

**Week 6**

| Week | CLO | Learning outcomes | Time | Learning activities | Assessment |
|---|---|---|---|---|---|
| 6.1 | CLO1<br><br>CLO3 | Able to describe the mechanisms of genetic variation<br>Able to describe the impact of genetic variation in microbial evolution and disease | 2 hr | Lectures and discussion | Clicker questions<br>Recitation questions |
| 6.2 | CLO1,2,3 | Review | 2 hr | Various apps and flashcards | Recitation questions |

**Week 7**

| Week | CLO | Learning outcomes | Time | Learning activities | Assessment |
|---|---|---|---|---|---|
| 7.1 | | Mid-term assessment | 2 hr | Written assessment | Written assessment |
| 7.2 | CLO2 | Effective collaborative learning and preparation for a group presentation on biogeochemical cycling, marine and freshwater ecosystem, and terrestrial ecosystem | 2 hr | Group discussion and preparation for an oral presentation | Submission of preparation visual-aid |

**Week 8**

| Week | CLO | Learning outcomes | Time | Learning activities | Assessment |
|---|---|---|---|---|---|
| 8.1 | CLO4 | Deliver an effective written communication in microbiology | 2 hr | Lectures and discussion | Rubric |
| 8.2 | CLO2,4 | Able to describe different types of microbial interactions | 2 hr | Lecture and discussion | Recitation questions |

| | | | | | |
|---|---|---|---|---|---|
| | CLO2,3<br><br><br><br>CLO2 | Able to apply the microbial interactions in various contexts such as clinical, agricultural, food, and industrial<br>Able to describe the archaeal adaptations in the environment such as high temperature and high salinity | | | |

**Week 9**

| Week | CLO | Learning outcomes | Time | Learning activities | Assessment |
|---|---|---|---|---|---|
| 9.1 | CLO2<br>CLO3 | Able to describe the bacterial diversity<br>Able to analysis the impact of bacteria in clinical, hygiene and sanitation, and industrial contexts | 2 hr | Lectures and discussion<br>Case analysis of water sanitation | Recitation questions |
| 9.2 | CLO2<br><br>CLO2<br><br>CLO3 | Able to distinguish between different singled-cell eukaryotes and prokaryotes<br>Able to describe the unique modes of nutritions of the protists<br>Able to provide examples of important protists in clinical and environmental contexts | 2 hr | Lecture and discussion | Recitation questions |

**Week 10**

| Week | CLO | Learning outcomes | Time | Learning activities | Assessment |
|---|---|---|---|---|---|
| 10.1 | CLO2<br><br>CLO2<br><br>CLO3<br><br>CLO1<br><br>CLO1 | Able to describe the unique morphology of fungi<br>Able to explain differing mode of fungal nutrition<br>Able to describe the applications of fungi in industrial production<br>Able to differentiate the Baltimore groups of viruses | 2 hr | Lectures and discussion | Recitation questions |

| | | | | | |
|---|---|---|---|---|---|
| | | Able to describe the unique strategies used by single- and double-stranded DNA and RNA viruses in synthesizing their nucleic acids and proteins | | | |
| 10.2 | CLO2<br><br><br><br>CLO2 | Able to identify major components of the mammalian host innate immunity<br>Able to explain the functions and how the innate immunity protects the host | 2 hr | Lecture and discussion | Recitation questions |

**Week 11**

| Week | CLO | Learning outcomes | Time | Learning activities | Assessment |
|---|---|---|---|---|---|
| 11.1 | CLO2,3<br><br>CLO2,3<br><br>CLO2,3<br><br><br>CLO2,3 | Able to identify the role and function of components in adaptive immunity<br>Able to contrast between host innate resistance and adaptive resistance<br>Able to distinguish between the active and passive forms of natural and artificial immunity<br>Able to define the method by which a host distinguishes itself from nonself (foreign) materials | 3 hr | Lectures and discussion | Recitation questions |
| 11.2 | CLO2,3<br><br><br>CLO2,3<br><br><br>CLO2,3 | Able to describe the microbial virulence factors and host cell response that result in disease<br>Able to describe the chain of events that lead to an infection<br>Able to identify and describe the features that allow microorganisms to overcome host resistance and immunity | 2 hr | Lecture and discussion | Recitation questions |

**Week 12**

| Week | CLOs | Learning outcomes | Time | Learning activities | Assessment |
|---|---|---|---|---|---|

| | | | | | |
|---|---|---|---|---|---|
| 12.1 | CLO1<br><br>CLO1 | Able to describe the basic biology of helminths<br>Able to identify the helminths' life cycle that lead to disease | 2 hr | Lectures and discussion | Recitation questions |
| 12.2 | CLO3<br><br>CLO2<br><br>CLO3 | Able to list at least five industrial products made by microbes<br>Able to describe the set up and components in microbial fermentation<br>Able to describe the desirable microbial characteristics that are applicable in industrial microbiology | 1 hr | Lecture and discussion | Recitation questions |

## 2. Plan for Assessment of Expected Course-Level Learning Outcomes (CLOs)

### 2.1 Measurement and Evaluation of learning achievement

#### A. Formative Assessment

Study questions

Case for discussion

#### B. Summative Assessment

(1) Tool and weight for measurement and evaluation

| Learning Outcomes | Evaluation Method | | | | | Weight (Percentage) |
|---|---|---|---|---|---|---|
| | In-class assignments | Term paper | Quiz | Mid-term exam | Final exam | |
| CLO1 Describe the biology of microorganisms (e.g., viruses, bacteria, protozoa, helminths, and fungi), including cell structure and function, growth and division, energy and metabolism, metabolic pathways, microbial evolution and genetics, and information flow within a cell through written assignments and assessments | 10 | 5 | 5 | 15 | 5 | **40** |
| CLO2 Compare and contrast microbial diversity, interactions, microbial ecology, and impact of microorganisms in various environments/habitats using discussion and comprehension of case studies | 3 | 5 | | 5 | 10 | **23** |
| CLO3 Analyze the knowledge of microorganisms in the contexts of health, sanitation, food processing, and industry by writing a term paper | 2 | 5 | | 5 | 15 | **27** |
| CLO4 Effective written communication in microbiology (i.e., write a literature review) | | **10** | | | | **10** |
| **Total** | **15** | **25** | **5** | **25** | **30** | **100** |

(2) Grading Rules

According to MUIC policy

| Grade | Achievement | Final Score (% Range) | GPA |
|---|---|---|---|

| | | | |
|---|---|---|---|
| A | Excellent | 90-100 | 4.0 |
| B+ | Very good | 85-89 | 3.5 |
| B | Good | 80-84 | 3.0 |
| C+ | Fairy good | 75-79 | 2.5 |
| C | Fair | 70-74 | 2.0 |
| D+ | Poor | 65-69 | 1.5 |
| D | Very poor | 60-64 | 1.0 |
| F | Fail | Less than 60 | 0.0 |

*Other letter grades, without credit points, are assigned as follows: I – Incomplete (awaiting evaluation); T – Transfer of credit; X – No report from the instructor; P – In progress (the study is incomplete); S – Satisfactory; U – Unsatisfactory; AU – Audit (a study which leads to no credit); W – Withdrawal

** assignment of other letter grades will follow the policies and rules outlined in Mahidol University International College Student Handbook 2024-2025.

(3) Measurement and Evaluation

More than 60 is pass.

**2.2 Re-examination (if the course allows any.)**

According to MUIC policy

**3. Students' Appeal**

According to MUIC policy

## Section 5 Teaching Resources

### 1. Required Texts

1. Willey JM, et al. Prescott's microbiology. 12th Ed. International Edition. Boston: McGraw-Hill Higher Education; 2022.

### 2. Suggested Materials

1. Cowan MK, et al. Microbiology Fundamentals: A clinical approach. 3rd Ed. International Edition. New York: McGraw Hill Education; 2019.
2. Madigan MT, et al. Brock biology of microorganisms. 16th Ed. Global Edition. Harlow, Essex: Pearson Education Limited; 2021.
3. Parker N, et al. Microbiology. Openstax™: Rice University; 2018.
4. Online academic databases (i.e., sciencedirect.com, isiwebofknowledge.com)

### 3. Other Resources (if any)

1. McLaughlin S, Petersen J. , Queensborough Community College. Laboratory Exercises in Microbiology: Discovering the Unseen World Through Hands-On Investigation. CUNY Academic Works; 2016. Available from: https://academic-works.cuny.edu/cgi/viewcontent.cgi?referer=&httpsredir=1&article=1015&context=qb_oers
2. Bruslind L. General Microbiology. 1st Ed. Oregon State University; 2021. Available from: https://open.oregonstate.education/generalmicrobiology/
3. Smith M, Selby S. Microbiology for Allied Health Students. University System of Georgia; 2017. Available from: https://oer.galileo.usg.edu/biology-textbooks/15/
4. Bruslind L. Allied Health Microbiology. Oregon State University; 2017. Available from: https://open.oregonstate.education/microbiology/

## Section 6 Evaluation and Improvement of Course Implementation

### 1. Analysis and Evaluation of Course Implementation

At the end of the course, students will assess the effectiveness of teaching and learning via MUIC Sky System. The evaluation will acquire anonymous students' feedback on course content, course management, faculty performance, and other suggestions

Reflective paragraph of the end of the course

Quantitative analysis of the performance of course assignments and assessments (mean, median, mode, and noticeable disparity)

Students' verbal feedback

### 2. Revision Process and Improvement Plan for Course Effectiveness

Students' feedbacks

A mid-course survey using the Start-Stop-Continue method

Reflection and submission of TQF5

Acquire students' verbal feedback on formal written assessments regarding the structure and management of the assignments and assessments

Review the course before the trimester starts through reflection and reviewing of TQF5

### 3. The self-assessment report of the course

Continuously obtain students' feedback throughout the course

Allocation of time and alteration of teaching pace as appropriate

Invite a guest instructor to observe the class. Guest instructor provides class observation feedback

Review the objectives and goals before each teaching period

Reflective paragraph by the instructor

# Appendix

## 1. Relations between the course and the program

**Table 1** Relations between the course and the PLOs

| General Microbiology | PLOs | | | | | |
|---|---|---|---|---|---|---|
| | PLO1 | PLO2 | PLO3 | PLO4 | PLO5 | PLO6 |
| ICBI 214 | R | R | I | | | |

**Table 2 Relations between CLOs and PLOs**

| ICBI 214 | PLOs | | | | | |
|---|---|---|---|---|---|---|
| | PLO1 | PLO2 | PLO3 | PLO4 | PLO5 | PLO6 |
| CLO1 - Describe the biology of microorganisms (e.g., viruses, bacteria, protozoa, helminths, and fungi), including cell structure and function, growth and division, energy and metabolism, metabolic pathways, microbial evolution and genetics, and information flow within a cell through written assignments and assessments | 1.1, 1.2, 1.5 | 2.2, 2.3 | | | | |
| CLO2 Distinguish and explain microbial diversity, interactions, microbial ecology, and impact of microorganisms in various environments/habitats | 1.1, 1.2, 1.5 | 2.2, 2.3 | | | | |
| CLO3 Apply the knowledge of microorganisms in the contexts of health, sanitation, food processing, and industry. | 1.1, 1.2, 1.5 | 2.2, 2.3 | | | | |
| CLO4 Effective written communication in microbiology (i.e., write a literature review) | | | 3.2 | | | |

**Table 3** PLOs and SubPLOs that the course is responsible for

| Program Learning Outcomes (PLOs) | SubPLOs |
|---|---|
| 1. Apply knowledge and technical skills of diverse biological disciplines to address health, societal and environmental issues | 1.1 Explain the fundamental and detailed knowledge of biological sciences |
| | 1.2 Apply knowledge in biological sciences to address health, societal and environmental issues |
| | 1.3 Perform experimentation in laboratory or field |
| | 1.4 Apply technical skills in biological sciences to address health, societal and environmental issues |
| | 1.5 Integrate biological sciences knowledge and technical skills across different disciplines to solve problems in biological sciences |
| 2. Critically appraise information from scientific articles/journals, biological research methodology, and experimentation to draw a meaningful conclusion from the materials | 2.1 Explain qualitative and quantitative data and/or ideas in basic biological sciences |
| | 2.2 Draw meaningful conclusion from the learning materials such as scientific articles, research methodology, and scientific findings |
| | 2.3 Retrieve relevant scientific information independently from textbooks, literatures, and databases |
| | 2.4 Manage scientific literatures using a reference-management program |
| | 2.5 Assess the scientific relevance of information acquired to the objective at hand |
| 3. Proficient in oral and written communication of biological sciences concepts formally and informally to both scientific community and general audience | 3.1 Proficient in oral communication of ideas, concepts, and findings in biological sciences to both the scientific community and the wider society |

| | |
|---|---|
| | 3.2 Proficient in written communication of ideas, concepts, and findings biological sciences to both the scientific community and the wider society |
| 4. Apply scientific integrity, professionalism, and competencies to function independently as well as as a team player | 4.1 Maintain data integrity using appropriate tools and acceptable methods |
| | 4.2 Work independently or coordinate with others to complete tasks at hand |
| | 4.3 Apply concepts of lab and fieldwork safety when carrying out the tasks |
| | 4.4 Set, plan and accomplish the assigned project in a timely manner |
| 5. Apply moral and ethical values when dealing with issues relating to humans, animals, and the environment, enabling actions based on moral and ethical judgment | 5.1 Recognize ethical issues in human and animal experimentation |
| | 5.2 Recognize emerging ethical issues in biological sciences |
| | 5.3 Apply accepted ethical standards to resolve ethical dilemma |
| | 5.4 Implement the course of action in accordance with moral and ethical judgment |
| 6. Demonstrate innovative mindset to formulate and create solutions for situations relevant to oneself, the well-being of others, and the natural environment | 6.1 Formulate lines of enquiry to drive problem-solving relevant to oneself, the well-being of others, and the natural environment |
| | 6.2 Formulate a process for data acquisition based on scientific methodology |
| | 6.3 Demonstrate systematic and logical thinking in formulating solutions through the application of knowledge and technical skills acquired from the different biological science disciplines |
| | 6.4 Explain the potential for knowledge transfer to innovation |

| | |
|---|---|
| | 6.5 Create networks to learn from others and create new ideas |

## 2. Rubric scoring*

**ICBI 214 General Microbiology 4 (4-0-8), T.2/2023-2024**
**Marking Criteria for Term Paper (Grading Rubric)**

By Asst. Prof. Tumnoon Charaslertrangsi, Ph.D.

| Criteria | Outstanding(A) 100 | Exceed expectation (B) 90 | Acceptable/Fair (C) 80 | Could use improvement (D) 70 | Please improve 60 | Score 50 |
|---|---|---|---|---|---|---|
| **Neatness Spelling Grammar** | All writing conventions are observed without error (margins, font size, spacing, citation style), no errors in grammar, spelling, and punctuation. Sophisticated and persuasive tone and diction, Elegant and easy to read sentence structure | Writing conventions are observed with minimal mistakes. Some problems with punctuation, grammar, or style. Word choice is occasionally problematic. Some inconsistencies in tone. Not much variety in sentence structure | Multiple, minor errors in adherence to writing conventions. Some major grammatical errors (subject-verb or tense agreement, comma splices, split infinitives). Unclear, wordy, awkward, or imprecise diction. Overly emotional or informal tone | Significant grammatical errors should have been apparent during proofreading. Use of clichés and colloquialisms. Imprecise diction. Numerous instances of inappropriate or irrelevant argumentation and tone | Major improvement needed. Few writing conventions were observed. | /5 /5 /5 |
| **Layout/ organization** | Well structured, good flow of ideas and concepts consistently | Well-organized, smooth transitions. At times, inconsistent | Clear purpose & scope. The organization is fair. At times, difficult to follow | Lack of flow of topics. Difficult to follow | Very difficult to follow | /5 |
| **Introduction** | Highly relevant content that introduces and addresses the issue. The importance of the problem is focused on and identified. A logical sequence followed. | Good introduction that leads into the content. Intro. raises concern about the issue. The reader quickly identifies and assesses the importance of the topic. | Introduction adequate and related. General idea conveyed, but lack essence of importance of issue. Logical sequence sometime followed. | Inadequately convey the issue, unrelated content that the reader could not clearly assess the importance of the issue | Lack of emphasis on the issue | /10 |
| **Relevance of material to a topic** | Highly relevant content. Directly, logically, and tie the idea together along with the topic. Insightful | Good selection of materials and contents, thorough. Insightful into the issue. Relevance seen well. | Generally and fairly relevant. Lack critical relevant and lack detail. Could improve | Lack of relevance of the materials. The connection could improve. | Lack of clear relevance | /20 |
| **Scientific content and critical analysis** | Scientific principles are clearly explained and relevant to the topic. In-depth, current, and thorough. Excellent coverage. Issues raised from the course addressed | Sound scientific and content explained, adequate, related, and efficient. Critical mechanism addressed. Contents, nevertheless, can be expanded further | Scientific concepts are shown and explained but could be expanded more. Touch on relevant aspects but not thorough. The certain part remains lacking thereof. | Concepts and principles are limited. Incomplete explanation of scientific content. Not thorough. Imprecise and has not been expanded from the course content. | Limited, not thorough. Please, please, please improve | /30 |
| **Coverage of literature and conclusions** | Addressing current issues and contradictions in ideas and literature. Thorough, broad, and logical coverage that reiterates the scientific content, following scientific principles. Range supports the paper well. Clear conclusions grounded on the rationale that tie into the idea of the paper | Good coverage of ideas and literature. Relevant, updated, adequate, and of interest to the issue. Presenting different perspectives of the topic. Some topics remain incomplete and can be expanded further. Sound conclusions with important concepts covered, supported by evidence and literature. | Fair coverage. Some portions become annotated bibliography. Supporting evidence is fair but may be limited. Coverage may not include every aspect of scientific principles. The logical sequence of literature is questionable. Some conclusions but lack supporting evidence. Some conclusions shifted from the idea of the paper | Annotated bibliography with one study after another. Limited coverage spectrum or one-sided presentation. Lacking support to the core idea of the paper. Literature isn't logically arranged. Conclusion shifted from the concept of the topic or lacking a clear decision—lack of supporting evidence. | Lack of coverage. Please, please, please spend more time on this work | /15 |
| **References** | Appropriate citation sources. Observed conventional format | Minor inconsistency in citation format but acceptable citation sources | Ref. inconsistency and unacceptable source or vice versa | Unacceptable sources. Inconsistent citation format | Please improve | /5 |
| Neatness, spelling, grammar, layout, organization – 20%. Relevance of material to a topic, the logic of criticism, coverage of literature, reference – 80% | | | | | Total | /100 |

## 3. Relations between the course and Sustainable Development Goals (SDGs)

| | | |
|---|---|---|
| ☐ | SDG1 | No poverty |
| ☐ | SDG2 | Zero Hunger |
| X | SDG3 | Good Health and Well – being |
| ☐ | SDG4 | Quality Education |
| ☐ | SDG5 | Gender Equality |
| ☐ | SDG6 | Clean Water and Sanitation |
| ☐ | SDG7 | Affordable and Clean Energy |

| | | |
|---|---|---|
| ☐ | SDG8 | Decent Work and Economic Growth |
| X | SDG9 | Industry, Innovation and Infrastructure |
| ☐ | SDG10 | Reduced Inequalities |
| X | SGD11 | Sustainable Cities and Communities |
| X | SDG12 | Responsible Consumption and Production |
| ☐ | SDG13 | Climate Action |
| ☐ | SDG14 | Life Below Water |
| ☐ | SDG15 | Life on Land |
| ☐ | SDG16 | Peace, Justice and Strong Institutions |
| ☐ | SDG17 | Partnerships for the goals |