

## Annex B

### 1. REVISED COURSE CONTENT (MS7420)

<b>Academic Year</b>	2022/23	<b>Semester</b>	1
<b>Course Coordinator</b>	Luciana Lisa Lao		
<b>Course Code</b>	MS7420		
<b>Course Title</b>	Biomaterials		
<b>Pre-requisites</b>	NIL		
<b>No of AUs</b>	2		
<b>Contact Hours</b>	26		
<b>Proposal Date</b>	20 Jan 2022		
<b>Suggested Class Size</b>	40		

#### **Course Aims**

This course will introduce you to the interdisciplinary field of biomaterials and their use in healthcare. In particular, you will learn about how host responds to biomaterials when they are implanted in the body and the possible complications that may arise. Various in vitro and in vivo compatibility tests will be introduced too. Finally, you will delve into some key applications of metallic and ceramic biomaterials as hard tissue replacements / supports.

#### **Intended Learning Outcomes (ILO)**

By the end of this course, you should be able to:

1. Define key terms and concepts in biomaterials science
2. Illustrate ethical issues relevant to the development and use of medical devices
3. Summarize guidelines to minimize risk of harm and protect the rights of animal and human test subjects
4. Describe the main processes that give rise to the host response to implants and biomaterials
5. Explain possible complications arising from an undesired host response
6. Apply ISO 10993 test matrix to evaluate the biocompatibility of a biomaterial
7. Explain the basic structure and properties of metallic and ceramic materials
8. Describe properties of specific metallic and ceramic biomaterials and their application areas in the body
9. Describe the main ways metallic and ceramic materials degrade in the body, considering both intentional and unintentional degradation

#### **Course Content**

- Introduction (key concepts, evolution of biomaterials and ethical issues)
- Tissue – Material Interactions (Tissue-biomaterial interface, wound healing with and without implants, immune response, biomaterial complications, determination of biocompatibility and regulatory aspects)
- Metals and Ceramics in Medicine (structure and properties, application and degradation of metallic and ceramic biomaterials)

#### **Assessment (includes both continuous and summative assessment)**

*Note: It is advised that Group component and class participation should not be more than 40% and 20% respectively, unless with good justification.*

Component	ILO Tested	Weighting	Team/Individual	Assessment Rubrics
1. Continuous Assessment 1 (CA1): Class Test	1, 2, 3, 4, 5, 6	50%	Individual	N/A
2. Continuous Assessment 2 (CA2): Class Test	7, 8, 9	50%	Individual	N/A
Total		100%		

### Formative feedback

- In-video tutorial questions are available so that you can gauge your understanding of the topics discussed. Immediate feedback has been incorporated to guide you to revise a particular concept whenever you provide wrong answers.
- You will be informed of your CA marks after each CA
- General feedback on common mistakes will be provided after each CA
- You are encouraged to drop by coordinator's office during the consultation hours to browse through your papers and discuss any issues, if needed.

### Learning and Teaching Approach

*Note: Please include and indicate TEL component.*

Approach	How does this approach support you in achieving the learning outcomes?
Blended learning with active use of multi-media resources (TEL)	This will permit flexibility of access to learning materials, activities and assessments and can help you develop independent learning and critical thinking skills.
Showing real-world applications	Most of the concepts that are dealt in the course have real-world implications and applications. Therefore, they are used as examples while discussing the related concepts.
Weekly Consultation	Weekly consultation hours will be available to encourage discussions that will reinforce students' understanding on various concepts and applications. Instead of providing answers directly to students' queries, they will be guided to think and make intelligent guesses based on sound principles. This approach will cultivate critical thinking.

### Reading and References

- Biomaterials Science – An Introduction to Materials in Medicine, 2nd edition, Buddy Ratner, Allan Hoffman, Frederick Schoen, Jack Lemons, Academic Press 2004.
- Biomaterials – An Introduction, 3rd edition, Joon Park, R. S. Lakes, Springer, 2007.
- Biomaterials – A Basic Introduction, 1st edition, Qizhi Chen, George Thouas, CRC Press, 2018.

### Course Policies and Student Responsibilities

#### (1) General

You are expected to complete all assigned pre-class readings and activities and watch all recorded lecture videos. You are expected to take responsibility to follow up with course notes and course related announcements throughout the semester. You are expected to adhere to the suggested weekly schedule.

#### (2) Absenteeism from CA

Absence from a class test without a valid reason will affect your overall course grade. Valid reasons include falling sick supported by a medical certificate and participation in NTU's approved activities supported by an excuse letter from the relevant bodies.

### Academic Integrity

Good academic work depends on honesty and ethical behaviour. The quality of your work as a student relies on adhering to the principles of academic integrity and to the NTU Honour Code, a set of values shared by the whole university community. Truth, Trust and Justice are at the core of NTU's shared values.

As a student, it is important that you recognize your responsibilities in understanding and applying the principles of academic integrity in all the work you do at NTU. Not knowing what is involved in maintaining academic integrity does not excuse academic dishonesty. You need to actively equip yourself with strategies to avoid all forms of academic dishonesty, including plagiarism, academic fraud, collusion and cheating. If you are uncertain of the definitions of any of these terms, you should go to the [academic integrity website](#) for more information. Consult your instructor(s) if you need any clarification about the requirements of academic integrity in the course.

### Course Instructors

Instructor	Office Location	Phone	Email
Luciana Lisa Lao	N4.1-01-09	65923202	LLLao@ntu.edu.sg

### Planned Weekly Schedule

Week	Topic	ILO	Readings/ Activities
1	Introduction – Key concepts and Definition	1	Lecture and in video tutorials
2	Evolution of biomaterials and ethical issues of biomaterials	2, 3	Lecture and in video tutorials

3	Tissue – material interface, stage of wound healing	4	Lecture and in video tutorials
4	Immune response	4	Lecture and in video tutorials
5	Biomaterial complications	5	Lecture and in video tutorials
6	Determination of biocompatibility and regulatory aspects	6	Lecture and in video tutorials
7	CA1	1, 2, 3, 4, 5, 6	-
8	Structure and properties of metallic materials	7	Lecture and in video tutorials
9	Applications of metallic biomaterials	8	Lecture and in video tutorials
10	Degradation of metallic biomaterials	9	Lecture and in video tutorials
11	Structure and properties of ceramic materials	7	Lecture and in video tutorials
12	Applications of ceramic biomaterials and their degradation	8, 9	Lecture and in video tutorials
13	CA2	7, 8, 9	-