

## Annex A

### 1. NEW COURSE CONTENT (MS7450)

<b>Academic Year</b>	2022/23	<b>Semester</b>	1
<b>Course Coordinator</b>	Luciana Lisa Lao		
<b>Course Code</b>	MS7450		
<b>Course Title</b>	Advanced Topics in Biomaterials		
<b>Pre-requisites</b>	MS7420 (pre-req or co-req)		
<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 is a continuation of MS7420 Biomaterials course. In this advanced course, you will learn about the use of various classes of polymers such as inert polymers, biodegradable polymers, responsive polymers, hydrogels, natural polymers and their key applications as soft tissue replacements or supports. In the second half, you will learn about tissue engineering concepts and approaches to regenerate new tissues/organs. Topics related to drug delivery and various mechanisms of drug delivery will be covered too.

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

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

1. Define polymers and explain the basic structure and properties of polymeric materials
2. Describe hydrogels, their swelling characteristics, and specific applications in medicine
3. Summarize requirements of polymeric biomaterials and explain possible deterioration of polymers
4. Describe properties of selected polymeric biomaterials and their application areas in medicine
5. Explain biodegradable polymers, their degradation mechanisms and use in medicine
6. Describe natural polymers, their classification, and advantages/disadvantages as biomaterials
7. Define tissue engineering and describe the principles and components of tissue engineering
8. Compare and contrast sources of cells in tissue engineering
9. Explain the role of materials in tissue engineering, particularly as a scaffold for tissue regeneration
10. Define drug delivery and illustrate various types of drug delivery
11. Explain the principles and applications of diffusion-, osmotic- and degradation-controlled release systems

#### **Course Content**

- Polymers in Medicine (structure and property of polymers, hydrogels, nondegradable polymers, biodegradable polymers, natural polymers)
- Tissue Engineering (principles of tissue engineering, cells sources, scaffold and environmental factors of tissue engineering)
- Drug Delivery (principles of drug delivery, modelling of drug delivery, diffusion-controlled system, osmotic-controlled system and degradation-controlled system)

**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	35%	Individual	N/A
2. Continuous Assessment 2 (CA2): Class Test	7, 8, 9, 10, 11	35%	Individual	N/A
3. Group Project: Essay	1 - 11	30%	Team	Appendix 1
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.
- Your group will receive formative feedback through written responses to your draft essay and verbal feedback through weekly consultations.

**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.
- Principles of Tissue Engineering, 4th edition, R.P.Lanza, R.Langer, J.Vacanti, Editors. Academic Press, 2014.
- Treatise on Controlled Drug Delivery, A Kydonieus, Ed., Marcel Dekker, 1992.

### 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 and submit your assignment(s) by due dates.

#### (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
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Luciana Lisa Lao	N4.1-01-09	65923202	LLLao@ntu.edu.sg

### Planned Weekly Schedule

Week	Topic	ILO	Readings/ Activities
1	Structure, Property and States of Polymers	1	Lecture and in video tutorials
2	Deterioration of Polymers and Hydrogels	2, 3	Lecture and in video tutorials
3	Nondegradable Polymers in Medicine	4	Lecture and in video tutorials
4	Degradable Polymers in Medicine	5	Lecture and in video tutorials
5	Natural Polymers	6	Lecture and in video tutorials
6	CA1	1, 2, 3, 4, 5, 6	-
7	Introduction to Tissue Engineering	7	Lecture and in video tutorials
8	Cell Sources and Scaffolds for Tissue Engineering	8, 9	Lecture and in video tutorials
9	Introduction to Drug Delivery and Modeling of Drug Delivery	10	Lecture and in video tutorials
10	Diffusion and osmotic-controlled release systems	10	Lecture and in video tutorials
11	Degradation-controlled release systems	11	Lecture and in video tutorials
12	CA2	7, 8, 9, 10, 11	-
13	Group Project submission and Peer Review	1 - 11	-