Annexe A: New/Revised Course Content in OBTL+ Format

Course Overview

The sections shown on this interface are based on the templates UG OBTL+ or PG OBTL+
If you are revising/duplicating an existing course and do not see the pre-filled contents you expect in the subsequent sections e.g. Course Aims, Intended Learning Outcomes etc. please refer to Data Transformation Status for more information.

Expected Implementation in Academic Year	AY2024-2025
Semester/Trimester/Others (specify approx. Start/End date)	Semester 2
Course Author * Faculty proposing/revising the course	Dr Subramanian Venkatraman
Course Author Email	msegraduate@ntu.edu.sg
Course Title	Polymers in Medicine: Macro/Micro/Nano
Course Code	MS7490
Academic Units	2
Contact Hours	26
Research Experience Components	

Course Requisites (if applicable)

Pre-requisites	
Co-requisites	
Pre-requisite to	
Mutually exclusive to	
Replacement course to	
Remarks (if any)	

Course Aims

This course covers the fundamental structure-property relationships in polymeric biomaterials, including polymer-tissue interactions. It will focus on applications of polymeric biomaterials in drug and gene delivery; tissue engineering; and nanomedicine including its use in vaccine. It covers advances in various polymer classes, from bio-inert to bioactive to biomimetic polymers.

Course's Intended Learning Outcomes (ILOs)

Upon the successful completion of this course, you (student) would be able to:

ILO 1	Understand the structure and properties of polymers in relation to their performance in medicine.
ILO 2	Understand Polymer-Tissue interactions in relation to Biocompatibility and Bioactivity.
ILO 3	Fundamental concepts of gelation/amorphous/semi-crystalline polymers.
ILO 4	Apply knowledge of the relative value of biostable/biodegradable/biomimetic to relevant medical device concepts.
ILO 5	Evaluate the critical applications of polymers in medicine, including Nanomedicine.
ILO 6	Use knowledge of the role of biomimetics in product design and development to develop alternatives to existing products.
ILO 7	Design novel constructs and polymers to address currently unmet needs in medicine.

Course Content

The following topics will be covered in the course:

1. The interactions of biomaterials with human tissues
2. Biocompatibility
3. Metals, ceramics and polymeric biomaterials and their applications
4. Biostable/Biodegradable/Biomimetic Polymer classes
5. Degradable Polymeric biomaterials and their uses
6. History of Nanomedicine and the role of biomaterials
7. Polymeric Nanobiomaterials, and how they are changing the face of medicine,
8. Medical devices, including drug delivery systems, tissue-engineered implants;
9. Functionalized biomaterials and their role in diagnostics
10. Cardiovascular, ocular and orthopaedic applications of biomaterials.

Reading and References (if applicable)

1. BIOMATERIALS, Q Chen and G Thouas, CRC Press, 2015 (this will be used as a general reference)

2. UNDERSTANDING NANOMEDICINE, Burgess, Pan Stanford, 2012.

3. Review papers in Drug delivery/Tissue Engineering/Nanomedicine

Planned Schedule

Week or Session	Topics or Themes	ILO	Readings	Delivery Mode	Activities
1	Introduction to Biomaterials	1-3	Biomaterials, Chapter 1	In-person	Lecture
2	Biocompatibility concepts	1-3	Biomaterials, Chapter 2 and Chapter 19	In-person	Lecture
3	Polymer Basics: Gels/composites /elastomers	1-3	Biomaterials, Chapter 8	In-person	Lecture
4	Polymer Classes 1: Natural Polymers and Biomimetic polymers	1-3	N/A	In-person	Lecture
5	Drug/Protein Delivery fundamentals	4-5	Notes	In-person	Lecture
6	Polymer Classes 2: Biodegradable Polymers Sutures/implants/biodegradation	4-5	Biomaterials, Chapter 10	In-person	Lecture
7	Tissue Repair and Engineering: New body parts for Old	4-5	Review Article 1	In-person	Lecture
8	CA1 Revision and Consultation	1-3, 5	N/A	In-person	CA1 revision and consultation
9	CA1 Quiz	1-3,5	N/A	In-person	CA1 quiz
10	Coatings: Blood-contacting Devices: Stents and Catheters	4-5	Review article 2	In-person	Lecture

Week or Session	Topics or Themes	ILO	Readings	Delivery Mode	Activities
11	Nanomedicine: Gene Delivery fundamentals, including mRNA Vaccines	6-7	Review article 3	In-person	Lecture
12	Biomimetic Design: Artificial Blood Vessel application	6-7	Review article 4	In-person	Lecture
13	CA2 Consultation	4, 6-7	N/A	In-person	CA2 consultation & submission

Learning and Teaching Approach

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	Concepts and features of polymers discussed here are related to their performance in applications in medicine. Case studies will put the role of polymers in medicine, in context.
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.

Assessment Structure

Assessment Components (includes both continuous and summative assessment)

No.	Component	ILO	Related PLO or Accreditation	Weightage	Team/Individual	Rubrics	Level of Understanding
1	Continuous Assessment (CA): Test/Quiz(Continuous Assessment 1 (CA1): Individual Quiz)	1-3,5	N/A	60	Individual	Holistic	Multistructural
2	Continuous Assessment (CA): Presentation(Continuous Assessment 2 (CA2): Group recorded presentation)	4,6,7	N/A	40	Team	Holistic	Relational

Description of Assessment Components (if applicable)

Continuous Assessment (CA) 1: Individual Quiz
The assessment will test the students on their grasp of concepts and application.
Duration: 1.5 hours; MCQ and short-answer questions; about 15-20 questions.

Continuous Assessment (CA) 2: Group recorded presentation
Recorded group presentation on a medical device/drug delivery application in which polymer plays a key role.
Recording duration: max 30 minutes; 10-12 teams total

Formative Feedback

- In-video tutorial classes and discussions / feedback during group presentations
- Grading and general feedback 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.

NTU Graduate Attributes/Competency Mapping

This course intends to develop the following graduate attributes and competencies (maximum 5 most relevant)

Attributes/Competency	Level
Collaboration	Intermediate
Curiosity	Intermediate
Problem Solving	Advanced
Transdisciplinarity	Advanced

Course Policy

Policy (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. On the use of technological tools (such as Generative AI tools), different courses / assignments have different intended learning outcomes. Students should refer to the specific assignment instructions on their use and requirements and/or consult your instructors on how you can use these tools to help your learning. Consult your instructor(s) if you need any clarification about the requirements of academic integrity in the course.

Policy (General)

You are expected to complete all assigned readings, activities, assignments, attend all classes punctually and complete all scheduled assignments by due dates. You are expected to take responsibility to follow up with assignments and course related announcements. You are expected to participate in all project critiques, class discussions and activities.

Policy (Absenteeism)

In-class activities make up a significant portion of your course grade. Absence from class without a valid reason will affect your participation 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. There will be no make-up opportunities for in-class activities.

Policy (Others, if applicable)

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Last Updated By: Tan Yong Lay Hayden