The Hong Kong University of Science and Technology (Guangzhou)

UG Course Syllabus Template

[Course Title] Manufacturing Process and Systems

[Course Code] SMMG 4020

[No. of Credits] 4

[Any pre-requisites] UFUG 1501 General Physics I **OR** UFUG 1503 Honors General Physics I

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Office Hours: Thursday 3-5 pm at w4-609, or by appointment via KLMS during the term time.

Course Description

This course introduces manufacturing processes of how products are manufactured from raw materials, including metal shaping, polymer processing, and emerging techniques such as additive manufacturing and micro/nano fabrication. This course also covers basic structures of engineering materials, as well as their physical and mechanical properties and how these relate to manufacturing processes. Finally, students will explore how manufacturing systems are designed for processing, inspection, testing, numerical control, and product quality control.

Intended Learning Outcomes (ILOs)

By the end of this course, students are expected to be able to achieve the following:

	Course ILOs	**Nature of the learning outcomes** *A - Knowledge/Content Related;* *B - Academic kills/Competencies;* *C - Others*
1	Demonstrate comprehensive knowledge of the major material processing and manufacturing techniques and their advantages and limitations.	*A, B*
2	Demonstrate understanding of the challenges in current materials design, processing and manufacturing, and the opportunities in industry and academia.	*A, B*
3	Identify the physics and key processing parameters in current manufacturing processes.	*A, B*
4	Obtain systematic understanding of process-structure-property relationships across different length scales in manufacturing.	*A, B, C*

5	Acquire the skills and confidence to create innovative solutions using manufacturing and material processing knowledge across a vast opportunity space.	*B, C*
6	Acquire a cutting-edge perspective on digital transformation of materials and the future manufacturing.	*B, C*

Weekly course schedule and weekly-ILO

Week number	**Topics**	**Weekly intended learning outcomes (weekly ILOs)**
1	Introduction; microstructures of common engineering materials.	Know common engineering materials, and how their microstructure relate to mechanical properties.
2	Elastic and plastic behaviors of engineering materials, and their microstructural origins.	
3	Material selection process under stiffness and strength criteria (stiffness and strength-limited design).	Understand how material is related to processing in manufacturing, with critical analysis for examples from industry and academia.
4	Case studies to illustrate material selection with multiple constraints in manufacturing processes; the effect of shape in material selection.	
5	Phase transformation and microstructural origins during material solidification; phase diagram; introduction to casting of metals.	Know major processing techniques and their applicability; identify key physics and design rationale for manufacturing processes; achieve systematic understanding of process-structure-property relationships of various manufacturing;
6	Casting case study and common defects analysis; introduction to ductility and deformation processing. (mid-term exam)	
7	Microstructures in deformation processing; common forming techniques with case studies.	
8	Machining, joining, and welding with case studies; manufacturing process selection hierarchy. (tutorial session-1)	Build comprehensive understanding of manufacturing route design for real engineering cases.
9	Case studies on manufacturing process design and analysis; developing course project presentation.	
10	Emerging manufacturing techniques with case studies (including microfabrication, composite material processing, and 3D bioprinting). (tutorial session-2)	Know cutting-edge material and manufacturing; Skills and confidence to innovate material processing to tackle real-world challenges.
11		
12	Manufacturing strategies and capacity and inventory design and optimization. (mini-project presentation)	View manufacturing from system level and integrate with digital transformation for future manufacturing.
13	Manufacturing system optimization with lean manufacturing; logistics management.	

Assessment and Grading

This course will be assessed using criterion-referencing and grades will not be assigned using a curve. Detailed rubrics for each assignment are provided below, outlining the criteria used for evaluation. Example past-year exam papers with cribs will be provided on Canvas.

Assessments:

[List specific assessed tasks, exams, quizzes, their weightage, and due dates; perhaps, add a summary table as below, to precede the details for each assessment.]

Assessment Task	Contribution to Overall Course grade (%)	Due date
In class workshop (participation)	5 %	In class (8 workshops)
Assignment	15 %	Week 1-10
Mid-term exam	**30 %**	**Week 7**
Project + peer reflection	5 %	Weel 13
Final examination	**45 %**	**Week 15**

* Assessment marks for individual assessed tasks will be released within two weeks of the due date.

Mapping of Course ILOs to Assessment Tasks

Assessed Task	Mapped ILOs	Explanation
In class workshop	Align with weekly ILOs, and [ILO1, ILO2, ILO3]	Format: open questions as reflections or summaries supplementing the in-class discussions. Mapping: the workshop is not quiz, but to stimulate students' understanding of the topics and to reflect the discussions.
Assignments (written)		Format: written questions. Mapping: strength student's understanding and to practice the problem solving and transferable skills.
Project and peer reflection	[ILO2, ILO3, ILO4, ILO5]	Format: details on Canvas. Mapping: the project enables students to reflect and apply course content (ILO-2,3), to understand the rationale of manufacturing process design (ILO-3,4), and to build their confidence for innovation (ILO-5).
Mid-term and final exams (written)	[ILO1, ILO2, ILO3, ILO4, ILO6]	Format: written exams (example paper on Canvas). Mapping: comprehensive assessment.

Grading Rubrics

This course utilizes an absolute grading system as follows.

A: [100,85]; B: (85,70]; C: (70,55]; D: (55,40]; F: (40,0].

Subgrades (*e.g.*, A-, B+, *etc.*) will be assigned for every 5 points within these ranges.

Detailed grading rubrics and example papers are released on Canvas.

Final Grade Descriptors:

Grades	Short Description	Elaboration on subject grading description
A	Excellent Performance	Demonstrating a comprehensive understanding of material properties, the related manufacturing processes principles, and manufacturing systems. Showing appropriate critical reflections on current developments and challenges. Showing 'know-how' ability to propose innovative solutions with justifiable material-design-processing strategies consideration.

B	Good Performance	Demonstrating appropriate understanding of material properties, the related manufacturing processes principles, and manufacturing systems. Showing basic understanding on current developments and challenges. Knowing the rationale and relationship for material-design-processing strategies consideration.
C	Satisfactory Performance	Demonstrating understanding of material properties, the related manufacturing processes principles, and manufacturing systems. Partially knowing the rationale and relationship for material-design-processing strategies consideration.
D	Marginal Pass	Demonstrating partial understanding of material properties, the related manufacturing processes principles, and manufacturing systems. Not able to analysis the rationale and relationship for material-design-processing strategies consideration. Not able to provide critical thinking and comments for the field.
F	Fail	Demonstrating incomplete understanding of material properties, the related manufacturing processes principles, and manufacturing systems. Not able to analysis the rationale and relationship for material-design-processing strategies consideration.

Course AI Policy

AI is encouraged for in class workshop, assignments, and project preparation. Calculators and hardcopy Databook are allowed in class and in the written exams.

However, AI is ***not*** allowed to be used to generate peer-review comments.

Communication and Feedback

Assessment marks for individual assessed tasks will be communicated via Canvas within two weeks of submission. Feedback on assignments will include [specific details, *e.g.*, strengths, areas for improvement]. Students who have further questions about the feedback including marks should consult the instructor within five working days after the feedback is received.

Resubmission Policy

Resubmission of assignments will be requested to the course instructor.

Required Texts and Materials

Printed lecture handouts will be provided by the course instructor. Other materials to be accessed via Canvas.

Academic Integrity

Students are expected to adhere to the university's academic integrity policy. Students are expected to uphold HKUST(GZ)'s Academic Honor Code and to maintain the highest standards of academic integrity. The University has zero tolerance of academic misconduct. Please refer to Regulations for Academic Integrity and Student Conduct for the University's definition of plagiarism and ways to avoid cheating and plagiarism.