# MECH2520 Design and Manufacturing 1

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<th><strong>Course Code:</strong></th>
<th>MECH2520</th>
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<td><strong>Course Title:</strong></td>
<td>Design and Manufacturing 1</td>
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<td><strong>Required Course Or Elective Course:</strong></td>
<td>Required</td>
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<td><strong>Terms Offered (Credits):</strong></td>
<td>Spring, 3 credits</td>
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<td><strong>Faculty In Charge:</strong></td>
<td>Michael Wang</td>
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<td><strong>Pre/Co-Requisites:</strong></td>
<td>None</td>
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**Course Structure:**
- Lecture: 1 day per week (1.5 hours);
- Laboratory: 1 day per week (1.5 hours)
- Online videos and articles reading: Once per week (1 hour)

**Textbook/Required Material:**
- HKUST Library on line full text e-book database

**References:**
- British Standard – BS308
- [http://www.rxn.com/~demu001/mechdes/mechdes.php](http://www.rxn.com/~demu001/mechdes/mechdes.php) – mechanical design resources
**Bulletin Course Description:**
- Introduction to the engineering design process and engineering graphics
- Design specification and evaluation
- Geometric construction, sketching, orthographic projection, auxiliary views;
- Dimensioning and tolerancing
- Manufacturing methods
- Design for manufacturing
- Design for assembly.

**Course Topics:**
1. Engineering Design – Creative process; Design specification; Design evaluation; Product Lifecycle Management; Design Portfolio
2. Engineering Drawings - Communication tool; Drawing standards; Orthographic projection; 3D drawing
3. Dimensioning and Tolerancing – Basic concepts; Dimensional tolerances - Limits and fits, Cumulative tolerances and measurement
4. Material Selection -Types of materials; Design for X (Strength, Deformation);
5. Material Specification and Evaluation
6. Design Evaluation: Quality function deployment
7. Design for Assembly
8. Design for Manufacturing
9. Primary manufacturing processes - Mold and die related processes (casting, molding, forming, sheet metal forming, powder metallurgy, composite manufacturing)
10. Secondary manufacturing processes: Machining processes: (turning, drilling, shaping, milling, grinding and abrasive processes, non-traditional and thermal cutting processes)
11. Tertiary manufacturing processes – surface finishing processes (cleaning and surface treatments, coating and deposition processes)
12. Physical Vapor Deposition (PVD) and Chemical Vapor Desposition (CVD)
13. Manufacturing process selection

**Course Objectives:**
1. To provide the students with a basic understanding of the design process and procedure. (P-O3, P-O4, P-O5)
2. To provide the students with an understanding on dimension and tolerance specification and its importance in product design (P-O3)
3. To introduce the concept of material selection and design for assembly and manufacturing (P-O3, P-O5)
4. To introduce the basic manufacturing processes and the relevant design considerations (P-O3, P-O5)
5. To articulate effective design communication (P-O1)

**Course Outcomes:**

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<th>Course Outcomes: (correlated course objectives and program outcomes)</th>
<th>On successful completion of this course, students are expected to be able to:</th>
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<td>A. Develop an engineering design specification for a product based on initial concepts. (1, 5) (POC1, POC3, POC4, POC7, POC9, POC10, POC12)</td>
<td>Develop design alternatives and conduct design evaluation based on a design specification. (1, 3, 4) (POC3, POC4, POC9, POC10, POC11, POC12)</td>
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<td>B. Develop design alternatives and conduct design evaluation based on a design specification. (1, 3, 4) (POC3, POC4, POC9, POC10, POC11, POC12)</td>
<td>Communicate effectively via engineering drawings and design presentation. (5) (POC6, POC7, POC12)</td>
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<td>C. Communicate effectively via engineering drawings and design presentation. (5) (POC6, POC7, POC12)</td>
<td>Conduct detailed component design to meet the engineering specification of parts or assemblies. (2, 3, 4) (POC3, POC4, POC6, POC9, POC10, POC11, POC12)</td>
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<td>D. Conduct detailed component design to meet the engineering specification of parts or assemblies. (2, 3, 4) (POC3, POC4, POC6, POC9, POC10, POC11, POC12)</td>
<td>Select appropriate manufacturing processes for engineering parts based on design requirements. (2, 3, 4) (POC3, POC4, POC5, POC9, POC10, POC11, POC12)</td>
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**Assessment Tools:**
(correlated course outcomes)

- Assignments + online exercises (20%)
- Solidworks Practice Assignments (10%)
- Solidworks Module Design Assignment (25%)
- Quiz x 2 (10% Design and 10% Manufacturing) (10% x 2)
- Final Examination (Design and Manufacturing) (25%)

**BEng in Mechanical Engineering (4-year program)**

**Program Objectives:**

P-O1 Be able to communicate and perform as an effective engineering professional in both individual and team-based project environments,

P-O2 Have an international outlook with clear perspectives on the Pearl river Delta and Greater China,

P-O3 Be able to research, design, develop, test, evaluate and implement engineering solutions to problems that are of complexity encountered in professional practice and leadership,

P-O4 Clearly Consider the ethical implications and societal impacts of engineering solutions,

P-O5 Continuously improve through lifelong learning.

**Program Outcomes:**

POC1 ability to identify and formulate problems in multidisciplinary environment with an understanding of engineering issues and constraints;

POC2 ability to design and conduct experiments as well as analyze and interpret data;

POC3 ability to apply knowledge of mathematics, science, and engineering for problem solving in mechanical engineering and related sectors or for further education in a research career;

POC4 ability to develop specification and to design system, component, or process to meet needs;

POC5 ability to understand the manufacturability, maintainability, and recyclability of engineering system and components;

POC6 ability to use modern engineering tools, techniques, and skills in engineering practice;

POC7 ability to communicate effectively;

POC8 ability to function in multi-disciplinary teams and provide leadership;

POC9 broadly educated with an understanding of the impact of engineering solutions on issues such as economics, business, politics, environment, health and safety, sustainability, and societal context;

POC10 clear understanding of professional and ethical responsibilities;

POC11 recognition of the need for life-long learning and continuing education;

POC12 international outlook with knowledge of contemporary issues.