Subject Description Form

Subject Code	IC2135
Subject Title	**Material Processing and Technical Communication**
Credit Value	5 Training Credits
Level	2
Pre-requisite / Co-requisite/ Exclusion	Nil
Objectives	The objective of this subject is to enable students to learn the materials, equipment and processes employed in industry on material processing and how different processes can be grouped to generate different classes of geometry. From this subject, students acquire basic practical knowledge and skills in occupational health and safety, engineering drawing and CAD, materials processing, fabrication processes and basic PCB design and fabrication.
Intended Learning Outcomes	Upon completion of the subject, students will be able to: a. Explain the general duties related to occupational safety and identify common workplace hazards and corresponding control measures, and incident and emergency handling; b. Interpret and produce 2D orthographic engineering drawing used for the representation of 3D object; computer aided design CAD applications in construction of 3D objects, assembly of 3D objects; generation of 2D engineering drawings from 3D objects and assembly of 3D objects with tolerance dimensioning; c. Select and use common hand tools and appropriate machining and fabrication processes for basic engineering measurement, marking out, materials processing, bench fitting, materials jointing and parts assembly work; d. Demonstrate an understanding of the limitations of materials that affect the application, manufacturing processes and workflow to produce a designed product assembly in realizing the importance of tolerance; e. Recognize the basic concept of schematic capture; produce electronic schematics from scratch or design draft, and prepare a file for printing of PCB layout; and f. Fabricate PCB and build electronic assemblies and integrate electronic' Modules with other electro-mechanical parts.

Contribution to Programme Outcomes (Refer to Part I Section 10)	▪ Programme Outcome 1: Demonstrate an ability to apply knowledge of mathematics, science, and engineering appropriate to the Biomedical Engineering (BME) discipline. (Teach) ▪ Programme Outcome 3: Demonstrate an ability to design a system, component, or process relevant to BME to meet desired needs within realistic constraints, such as economic, environmental, social, political, ethical, health and safety, manufacturability and sustainability. (Teach and Practice) ▪ Programme Outcome 4: Demonstrate an ability to identify, formulate, and solve BME problems. (Teach and Practice) ▪ Programme Outcome 8: Demonstrate an ability to use the computer/IT tools relevant to the BME discipline along with an understanding of their processes and limitations. (Teach and Practice)
Subject Synopsis/ Indicative Syllabus	▪ **Occupational Safety:** General duties related to occupational safety. Safe systems of work. Common hazards in workplace and corresponding control measures: risk control strategy, job safety analysis, manual handling, hazards arising from noise, electricity, fire, and chemicals, and associated control. Machinery hazards and principles of guarding. Incident and emergency handling: emergency preparedness, responses, follow-up actions. ▪ **Application and Operation of Engineering drawing and CAD:** Introduction to engineering drawing and BS8888. Orthographic Projection: Principles of angle projection systems. Sectional views and Dimensioning standards. Technical Sketching: free-hand sketching of orthographic and isometric views; Assembly drawings. Introduction to CAD: pros and cons; need and use; software features of CAD system; interacting with computer in constructing a CAD drawing, 3D Solid Modeling. Documentation: dimensioning and plotting of a CAD drawing. ▪ **Material Processing:** Introduction of materials. Use of common hand tools. Marking out principle and bench work. Use of basic machining tools. 3D printing. Plastic forming, machining and fabrication. Sheet metal fabrication. Materials finishing and jointing. ▪ **Basic Electronics:** Introduction to electronics and its products. Introduction to electronic circuits and components. Soldering and de-soldering techniques and Surface Mount Technology appreciation. Selection of electronic tools and materials. PCB design, PCB fabrication process and photochemical etching. Use of basic electronic tools and equipments. Mounting and installation of electronic circuits, wiring of electronic assemblies, prototype making, electronic circuit trouble shooting techniques and functional tests.

Learning Methodology

- The teaching and learning methods include short lectures, tutorials, and workshop practice. These are organized in a project-based collaborative integrated learning approach.
- Short lectures/tutorials are aimed at providing students with an overall and concrete background knowledge required for understanding key issues in engineering communication, application of computer aided design systems, use of standard engineering components and systems, selected manufacturing processes and importance of industrial safety.
- The workshop practices are aimed at enhancing students' practical knowledge and ability in applying the knowledge and skills of selected manufacturing processes to complete specific tasks.
- Project-based integrated learning approach is applied to facilitate students to learn, practice, apply, and reflect the diverse topics in a coherent and unified manner. Collaborative learning provides opportunity for students to develop generic skills in teamwork and to learn from peers. These are adopted to enhance active and holistic learning to improve learning motivation as well as understanding of relationships among the diverse topics in material processing.

Assessment Methods in Alignment with Intended Learning Outcomes

Assessment Methods	Weighting (%)	Intended Learning Outcomes Assessed					
		a	**b**	**c**	**d**	**e**	**f**
1. Industrial Safety – Test – Report	10 (5) (5)	 ✓ ✓					
2. Project – Individual Workshop Performance – Group Performance	50 (30) (20)		✓ ✓	✓ ✓	✓ ✓	✓ ✓	✓ ✓
3. Presentation	15		✓	✓	✓	✓	✓
4. Written Report	25	✓	✓	✓	✓	✓	✓
Total	100						

Student's individual performance is accessed by in-class assignments, test and written report while presentation and integrated application oriented mini-project are used for assessing the group performance.

The integrated application oriented mini-project is designed to facilitate

	students to acquire the knowledge of different working principle and capability of manufacturing processes through team work. In order to facilitate students to better reflect and apply the knowledge periodically throughout the class, students are required to conduct in-class assignments in every learned subjects. Presentation is designed to facilitate students to show their group performances on applied different technologies in the product development workflow. Written report is designed to facilitate students to acquire deep understanding of the topics in order to present the concepts of the training clearly.	
Student Study Effort Required	**Class Contact**	
	▪ Lecture	4 Hrs.
	▪ Practical Training and Briefing Session	146 Hrs.
	Other Study Effort	
	▪ Self-study	0 Hrs.
	Total Study Effort	**150 Hrs.**
Reading List and References	▪ *Materials and Processes in Manufacturing*, by E. Paul Degarmo, Macmillan Publishing Co., Inc., New York. ▪ Special reading materials prepared by the Industrial Centre and the Rehabilitation Engineering Centre. ▪ OESS,InfoShare,*http://www2.ic.polyu.edu.hk/oess/POSH/student.htm*, Industrial Centre of The Hong Kong Polytechnic University.	