Politeknik Negeri Batam

Pusat Pengembangan Pembelajaran dan Penjaminan Mutu

Silabus Mata Kuliah
Program Studi

Diploma Tiga
Teknik Elektronika Manufaktur

Tahun : **2023**

1. Profil Profesional Mandiri (Program Educational Objectives)

Profil Profesional Mandiri	Deskripsi Profil
PEO-01	Lulusan akan memiliki karir yang sukses dalam profesinya di bidang manufaktur elektronika atau bidang terkait.
PEO-02	Lulusan akan menerapkan keterampilan pemecahan masalah, berpikir kritis, komunikasi, dan manajemen untuk menyelesaikan masalah teknis yang berkaitan dengan bidang manufaktur elektronika.
PEO-03	Lulusan akan menunjukkan kepemimpinan dan berperan aktif dalam peningkatan komunitasnya dan industri.

2. Kompetensi Utama

Program studi Diploma Tiga Teknik Elektronika Manufaktur mempunyai 2 kompetensi utama yaitu kompetensi di bidang IC packaging industry dan PCB Assembly (SMT).

3. Capaian Pembelajaran Lulusan (CPL) atau Student Outcomes (SO)

Kode	Deskripsi
SO-1	Kemampuan untuk menerapkan pengetahuan, teknik, keterampilan, dan alat modern matematika, sains, teknik, dan teknologi untuk memecahkan masalah teknik yang terdefinisi dengan baik yang sesuai dengan bidang manufaktur elektronika;
SO-2	Kemampuan merancang solusi untuk masalah teknis yang terdefinisi dengan baik dan membantu dengan desain teknik sistem, komponen, atau proses yang sesuai untuk bidang manufaktur elektronika;
SO-3	Kemampuan untuk menerapkan komunikasi tertulis, lisan, dan grafis dalam lingkungan teknis dan non-teknis yang terdefinisi dengan baik; dan kemampuan untuk mengidentifikasi dan menggunakan literatur teknis yang sesuai;
SO-4	Kemampuan untuk melakukan tes standar, pengukuran, dan eksperimen serta menganalisis dan menginterpretasikan hasilnya; dan
SO-5	Kemampuan untuk berfungsi secara efektif sebagai anggota tim teknis.

4. Prospek Kerja

a. Teknisi di industri IC Packaging atau industri semikonduktor
b. Teknisi di industri PCB Assembly atau Surface Mount Technology (SMT)

5. Peta Matakuliah

Peta Mata Kuliah Program Studi Teknik Elektronika Manufaktur dalam Bahasa Indonesia

Semester	Tema Proyek	CDIO Stage	Mata Kuliah								Program MBKM		
											Luar PT		
VI	Proyek Industri	C-D-I-O	Proyek Akhir	Cooperative Education							MBKM - Studi Independen	MBKM - Penelitian	MBKM - Kewirausahaan
V	Proyek Industri	C-D-I-O	Proposal Proyek Akhir	Magang Industri							MBKM - Studi Independen	MBKM - Penelitian	MBKM - Kewirausahaan
IV	PCB Assembly Process Project	C-D-I-O	Proyek Manufaktur Elektronika Industri	PCBA Rework and Repair	Surface Mount Technology	Metrologi Industri	Mikroelektronika Frekuensi Radio	Kewirausahaan	Bahasa Inggris	Kewarganegaraan	MBKM - Pertukaran Pelajar		
III	IC Packaging Project	D-I-O	Proyek Proses Manufaktur Elektronika	Gambar Teknik	IC Packaging	Statistical Process Control	Operasi Fasilitas Manufaktur Elektronika	Teknologi Fabrikasi Semikonduktor	Bahasa Indonesia	Pancasila	MBKM - Pertukaran Pelajar		
II	Manufaktur PCB dan Assembly secara Semi Otomatis	d-I-O	Proyek Manufaktur Elektronika Semi Otomatis	Devais Elektronika	Teknologi Material	Elektronika Digital	Sistem Mikrokontroler	Sistem Kendali	Manufaktur PCB	Olahraga	MBKM - Pertukaran Pelajar		
I	Manufaktur Single layer PCB dan Assembly secara Manual	I-O	Proyek Pengenalan Manufaktur Elektronika	Matematika Teknik	Kimia	Algoritma dan Pemrograman	Rangkaian Listrik	Fisika Terapan	Kesehatan, Keselamatan Kerja dan Lingkungan	Agama			

	: MBKM
	: Advance Engineering Fundamental Knowledge, Methods and Materials
	: Core Engineering Fundamental Knowledge
	: Knowledge of Underlying Mathematics and Sciences
	: Knowledge of Social Sciences and Humanities (Common Course / Supporting)

Peta Mata Kuliah Program Studi Teknik Elektronika Manufaktur dalam Bahasa Inggris

Semester	Project Theme	CDIO Stage	Course								MBKM Program Out of Campus		
VI	Industrial Project	C-D-I-O	Final Project	Cooperative Education							MBKM - Independent Study	MBKM - Research	MBKM - Entrepreneurship
V	Industrial Project	C-D-I-O	Final Project Proposal	Industrial Internship							MBKM - Independent Study	MBKM - Research	MBKM - Entrepreneurship
IV	PCB Assembly Process Project	C-D-I-O	Industrial Electronics Manufacturing Project	PCBA Rework and Repair	Surface Mount Technology	Industrial Metrology	Radio Frequency Microelectronics	Entrepreneurship	English	Citizenship	MBKM - Student Exchange		
III	IC Packaging Project	D-I-O	Electronics Manufacturing Process Project	Technical Drawing	IC Packaging	Statistical Process Control	Electronics Manufacturing Facility Operation	Semiconductor Fabrication Technology	Indonesian	Pancasila	MBKM - Student Exchange		
II	Semi-Automated PCB Manufacturing and Assembly	d-I-O	Semi-Automated Electronics Manufacturing Project	Electronics Devices	Material Engineering	Digital Electronics	Microcontroller System	Control System	PCB Manufacturing	Sports	MBKM - Student Exchange		
I	Manual Single Layer Manufacturing PCB and Assembly	I-O	Electronics Manufacturing Introduction Project	Engineering Mathematics	Chemistry	Algorithms and Programming	Electric Circuit	Applied Physics	Health, Safety and Environment	Religion			

	: MBKM Program
	: Advance Engineering Fundamental Knowledge, Methods and Materials
	: Core Engineering Fundamental Knowledge
	: Knowledge of Underlying Mathematics and Sciences
	: Knowledge of Social Sciences and Humanities (Common Course / Supporting)

Peta Mata Kuliah Program Studi Teknik Elektronika Manufaktur dengan Kurikulum Terintegrasi

Semester	Tema Proyek	CDIO Stage	Mata Kuliah								Program MBKM Luar PT		
VI	Proyek Industri	C-D-I-O	Proyek Akhir	Cooperative Education							MBKM - Studi Independen	MBKM - Penelitian	MBKM - Kewirausahaan
V	Proyek Industri	C-D-I-O	Proposal Proyek Akhir	Magang Industri							MBKM - Studi Independen	MBKM - Penelitian	MBKM - Kewirausahaan
IV	PCB Assembly Process Project	C-D-I-O	Proyek Manufaktur Elektronika Industri	PCBA Rework and Repair	Surface Mount Technology	Metrologi Industri	Mikroelektronik Frekuensi Radio	Kewirausahaan	Bahasa Inggris	Kewarganegaraan	MBKM - Pertukaran Pelajar		
III	IC Packaging Project	D-I-O	Proyek Proses Manufaktur Elektronika	Gambar Teknik	IC Packaging	Statistical Process Control	Operasi Fasilitas Manufaktur Elektronika	Teknologi Fabrikasi Semikonduktor	Bahasa Indonesia	Pancasila	MBKM - Pertukaran Pelajar		
II	Manufaktur PCB dan Assembly secara Semi Otomatis	d-I-O	Semi-automated Electronics Manufacturing Project	Devais Elektronika	Teknologi Material	Elektronika Digital	Sistem Mikrokontroler	Sistem Kendali	Manufaktur PCB	Olahraga	MBKM - Pertukaran Pelajar		
I	Manufaktur Single layer PCB dan Assembly secara Manual	I-O	Proyek Pengenalan Manufaktur Elektronika	Matematika Teknik	Kimia	Algoritma dan Pemrograman	Rangkaian Listrik	Fisika Terapan	Kesehatan, Keselamatan Kerja dan Lingkungan	Agama			

Mata Kuliah Mendukung Proyek

Product Development Skills | Written Communication | Communication in English | System Thinking | Team Work | Personal Skills | Professional Skills

6. Silabus Matakuliah

No.	Komponen Silabus		Deskripsi
Semester 1			
1.	Mata Kuliah	:	**Electronics Manufacturing Introduction Project**
	Kode	:	EM111
	SKS	:	2
	Deskripsi Mata Kuliah	:	This course will develop students' identity as modern engineers who contribute to society. The course also provides a framework for engineering practice in product, process, and system building and introduces the importance of personal and interpersonal skills. Students will engage in engineering practice through a simple electronics manufacturing project in a team. Students are required to demonstrate critical thinking, creative, and problem-solving skills during laboratory work.
2.	Mata Kuliah	:	**Engineering Mathematics**
	Kode	:	EM112
	SKS	:	3
	Deskripsi Mata Kuliah	:	This course learns about algebra, matrices and determinants, trigonometry, complex numbers, limits and derivatives, integrals, vectors, and introduction to statistics.
3.	Mata Kuliah	:	**Chemistry**
	Kode	:	EM113
	SKS	:	3
	Deskripsi Mata Kuliah	:	This course provides knowledge of basic chemistry that supports the electronics manufacturing process. Students are expected to have basic knowledge and aspects of chemical processes generally used in electronics manufacturing processes.
4.	Mata Kuliah	:	**Algorithms and Programming**
	Kode	:	EM114
	SKS	:	3
	Deskripsi Mata Kuliah	:	This course will equip students with knowledge of programming algorithms, the introduction of variables, data types, keywords, and operators. Programming with branching concepts (if, else-if, switch-case), looping concepts (for, while, do-while, break, continue), function concepts, arrays, strings, pointers, file structures and I/O. Software implementation includes design, writing, testing and debugging of program code.
5.	Mata Kuliah	:	**Electric Circuit**
	Kode	:	EM115
	SKS	:	3
	Deskripsi Mata Kuliah	:	This course learns about the basic concepts of electric circuits, basic laws of electric circuits, analysis methods (Node and Mesh), circuit theorems (superposition, Thevenin, Norton), understanding transient circuits (RC and RL), and introduction to AC circuits (RC, RL, RLC).
6.	Mata Kuliah	:	**Applied Physics**
	Kode	:	EM116
	SKS	:	3
	Deskripsi Mata Kuliah	:	This course contains physics concepts applied to solve problems in electronics manufacturing.
7.	Mata Kuliah	:	**Health, Safety and Environment**
	Kode	:	EM117
	SKS	:	2
	Deskripsi Mata Kuliah	:	This course equips students with the importance of occupational health, safety, and environment along with several methods/approaches to improve the health, safety, and environment of workers in particular. This course contains the principles and legal basis of health, safety, and environment. The HSE theories studied include fire prevention and control, hazard identification and risk control, safety signs, ergonomics, industrial hygiene, and first aid.
8.	Mata Kuliah	:	**Religion**
	Kode	:	PK1EM
	SKS	:	2
	Deskripsi Mata Kuliah	:	Religion is a compulsory course that must be followed by students. This course aims to form a complete student personality by making religious teachings the basis for thinking, behaving, and behaving in scientific and professional development.

Semester 2			
1.	Mata Kuliah	:	**Semi-Automated Electronics Manufacturing Project**
	Kode	:	EM211
	SKS	:	2
	Deskripsi Mata Kuliah	:	This course will develop students' identity as modern engineers who contribute to society. The course also provides a framework for engineering practice in product, process and system development and introduces the importance of personal and interpersonal skills. Students will engage in engineering practice through a simple semi-automated PCB manufacturing and PCB Assembly project in a team. Students are required to demonstrate critical thinking, creativity and problem solving skills during laboratory work.
2.	Mata Kuliah	:	**Electronics Devices**
	Kode	:	EM212
	SKS	:	3
	Deskripsi Mata Kuliah	:	This course studies basic semiconductor components such as diodes, bipolar junction transistors, thyristors (DIAC, TRIAC, SCR), FETs (JFET, MOSFET) and CMOS as well as signal amplifier circuits using transistors and operational amplifiers (Op-Amp) realized in electronic circuit applications.
3.	Mata Kuliah	:	**Material Engineering**
	Kode	:	EM213
	SKS	:	3
	Deskripsi Mata Kuliah	:	This course provides students with knowledge of material science and technology used in electronics manufacturing. Students are expected to have fairly complete basic knowledge of materials or materials generally used in the electronics manufacturing process.
4.	Mata Kuliah	:	**Digital Electronics**
	Kode	:	EM214
	SKS	:	3
	Deskripsi Mata Kuliah	:	This course provides an introduction to digital engineering in the form of number systems, logic gates, Boolean algebra, combination circuits, sequential circuits, and counter circuits, Analog to Digital Converter (ADC), Digital to Analog Converter (DAC) and Finite State Machine (FSM).
5.	Mata Kuliah	:	**Microcontroller System**
	Kode	:	EM215
	SKS	:	3
	Deskripsi Mata Kuliah	:	This course covers the concepts and basics of microcontroller programming, namely digital I/O, analog I/O, clock, interrupt, communication module, timer, memory, and watchdog time.
6.	Mata Kuliah	:	**Control System**
	Kode	:	EM216
	SKS	:	3
	Deskripsi Mata Kuliah	:	This course studies control theory, open and close loop control systems that include how to model circuits, block diagrams, electrical, and mechanical mathematically. This course determines the transfer function of a physical system to be implemented in relation to the electronics manufacturing process.
7.	Mata Kuliah	:	**PCB Manufacturing**
	Kode	:	EM217
	SKS	:	3
	Deskripsi Mata Kuliah	:	This course studies the PCB manufacturing process of both single layer PCBs and double layer PCBs. Testing and inspection refer to international standards such as IPC-A-600 and IPC-A-6012.
8.	Mata Kuliah	:	**Sports**
	Kode	:	EM218
	SKS	:	1
	Deskripsi Mata Kuliah	:	This course provides students with insights, knowledge, and learning experiences about Sports Health Science. This course covers the definition and scope of sports, preparticipation examination, physical fitness, sports for physical health, and selected physical sports that can be applied in everyday life.
Semester 3			
1.	Mata Kuliah	:	**Electronics Manufacturing Process Project**
	Kode	:	EM311
	SKS	:	2

	Deskripsi Mata Kuliah	:	This course will develop the students to be able to collaborate in multi-disciplinary groups to define, design, build, test, and release products. This course provides the students with opportunities to implement their design and process skills in electronics manufacturing.
2.	Mata Kuliah	:	**Technical Drawing**
	Kode	:	EM312
	SKS	:	2
	Deskripsi Mata Kuliah	:	This course studies the basic concepts of engineering drawings which include how to read drawings, drawings projections, drawing scales, make drawing heads, print drawings, and make drawings from 2D to 3D or 3D to 2D using Computer Aided Drafting (CAD) so that it produces electronics manufacturing system designs that consider regulatory and ergonomic standard factors.
3.	Mata Kuliah	:	**IC Packaging**
	Kode	:	EM313
	SKS	:	4
	Deskripsi Mata Kuliah	:	This course learns about the introduction of IC packaging technology (leaded, no-lead, and non-standard), IC technology development, and IC packaging process flow (leaded, QFN, BGA). The IC packaging process flow includes wafer dicing, die attach/die bonding, wire bonding, molding process, tin plating, labeling/marking, and dedambar/dejunk, trim-forming, and singulation (DTFS). Other technologies in IC packaging are also studied such as flip chip, reflow, underfill, gell fill, and glob top. The process and products produced refer to JEDEC standards and other industrial standards.
4.	Mata Kuliah	:	**Statistical Process Control**
	Kode	:	EM314
	SKS	:	3
	Deskripsi Mata Kuliah	:	This course studies process control techniques to calculate limits for defective products and how to prevent them using statistical methods. Statistical methods include 7 Quality Tools (Checksheet, Pareto diagram, fishbone diagram, scatter diagram, histogram, control chart, stratification), normal distribution, T-test, and statistical reports.
5.	Mata Kuliah	:	**Electronics Manufacturing Facility Operation**
	Kode	:	EM315
	SKS	:	2
	Deskripsi Mata Kuliah	:	This course contains the operation of clean room facilities and electronics manufacturing facilities in general and how to store raw materials in the electronics manufacturing process, especially the IC packaging process, PCB manufacturing, and Surface Mount Technology (SMT). Students also learn about facilities that use electrostatic discharge and make lot traveler documentation and storage of non-chemical consumables in the electronics manufacturing industry.
6.	Mata Kuliah	:	**Semiconductor Fabrication Technology**
	Kode	:	EM316
	SKS	:	3
	Deskripsi Mata Kuliah	:	This course studies the semiconductor (microelectronics) manufacturing process applied in the microelectronics industry by studying each stage of the microelectronics fabrication process, device and integrated circuit (IC) fabrication technology which includes the value-chain in the semiconductor industry, the chip/VLSI design service industry and the IC fabrication industry from silicon raw materials to wafers ready for packaging. The topics discussed are the technology, process sequence, and process equipment used in the main IC industry technologies such as CMOS and Bipolar technology. The detailed process of silicon wafers includes the preparation of silicon wafer raw materials, thermal oxidation process, photolithography, thermal diffusion, ion-implantation, Chemical Vapor Deposition (CVD), mask making, and basic IC layout design. This course also studies the effects of a semiconductor device (chip) on the IC Packaging process (IC Assembly).
7.	Mata Kuliah	:	**Indonesian**
	Kode	:	PK4EM
	SKS	:	2
	Deskripsi Mata Kuliah	:	Indonesian is one of the general compulsory courses. This course aims to develop student competence, especially in scientific writing and good literacy skills. The contribution of the competence of this course to the study program

			is the ability of students to use good and correct Indonesian to communicate problems related to the knowledge mastered by students to other people effectively.
8.	Mata Kuliah	:	**Pancasila**
	Kode	:	PK2EM
	SKS	:	2
	Deskripsi Mata Kuliah	:	Pancasila is one of the compulsory courses that must be followed by students. This course aims to deliver students in strengthening their personalities so that they are consistently able to realize the basic values of religion and culture, a sense of nationality, and love for the country throughout life.
Semester 4			
1.	Mata Kuliah	:	**Industrial Electronics Manufacturing Project**
	Kode	:	EM411
	SKS	:	2
	Deskripsi Mata Kuliah	:	Students are able to collaborate in a team both within the same discipline and multi-disciplinary to define, design, and build products. This course provides students with opportunities to set up machine parameters, corrective action, test, and release products in the field of electronics manufacturing.
2.	Mata Kuliah	:	**PCBA Rework and Repair**
	Kode	:	EM412
	SKS	:	3
	Deskripsi Mata Kuliah	:	This course studies inspection, rework, and repair for Printed Circuit Board Assembly (PCBA) with reference to IPC international standards such as IPC 7711/7721, IPC-A-610, and IPC J-STD-001. PCBA inspection is carried out for through-hole and surface mount device (SMD) components. Assembly and inspection of cables and wire harnesses of electronic products with reference to IPC WHMA-A-620 standards.
3.	Mata Kuliah	:	**Surface Mount Technology**
	Kode	:	EM413
	SKS	:	4
	Deskripsi Mata Kuliah	:	This course discusses the basic skills in PCB Assembly (PCBA) technology in the form of Surface Mount Technology (SMT) including technology, process sequence, and equipment used in the production process. This course also discusses advanced skills in standards and quality control as well as capacity design and optimization of SMT facility operations. In addition to SMT, the concept of wave soldering for through-hole component assembly is also covered.
4.	Mata Kuliah	:	**Industrial Metrology**
	Kode	:	EM414
	SKS	:	2
	Deskripsi Mata Kuliah	:	This course aims to equip students with measurement and inspection in the electronics manufacturing process using industry-standard measurement and inspection tools and their calibration. This course covers measurement and inspection using a microscope, caliper, screw micrometer, profile projector, wire pull, ball shear, depth gauge, and other inspection equipment related to electronics manufacturing. Measurement System Analysis (MSA) is also introduced in this course.
5.	Mata Kuliah	:	**Radio Frequency Microelectronics**
	Kode	:	EM415
	SKS	:	3
	Deskripsi Mata Kuliah	:	This course provides students with knowledge about the introduction of radio frequency electronics or microwaves and their uses in the real world.
6.	Mata Kuliah	:	**Entrepreneurship**
	Kode	:	EM416
	SKS	:	2
	Deskripsi Mata Kuliah	:	This course studies the spirit of entrepreneurship, the essence and concept of entrepreneurship, achievement motivation, creativity and innovation, business opportunities, business ethics and social responsibility, and business feasibility studies.
7.	Mata Kuliah	:	**English**
	Kode	:	EM417
	SKS	:	2
	Deskripsi Mata Kuliah	:	This course introduces students to the techniques of writing clear and correct messages and strategies for writing messages in English. The course topics

			include effective writing techniques and will provide students with exercises in the form of various types of emails, memos, letters, scientific papers, and work reports. The course also aims to prepare students to make presentations in English and be able to answer questions from participants of international conferences or other seminars. Students will learn and practice various aspects of academic presentations. Students will learn the main strategies needed to improve their communication skills and fluency.
8.	Mata Kuliah	:	**Citizenship**
	Kode	:	PK3EM
	SKS	:	2
	Deskripsi Mata Kuliah	:	Citizenship is a compulsory course that must be followed by students. This course aims to prepare students to become smart and good citizens.
Semester 5			
1.	Mata Kuliah	:	**Final Project Proposal**
	Kode	:	EM511
	SKS	:	2
	Deskripsi Mata Kuliah	:	This course is designed to accelerate the completion of students' studies by providing students with an understanding of the potential feasibility of problems found during the internship period in the industry to be used as a final project research study. Students are also equipped with material on proposal preparation techniques in accordance with the guidelines for preparing the final project and proposal presentation techniques. Students are required to raise a theme or final project topic obtained from the internship site or industry which is consulted with the supervisor and presented in the final project proposal seminar.
2.	Mata Kuliah	:	**Industrial Internship**
	Kode	:	EM512
	SKS	:	14
	Deskripsi Mata Kuliah	:	This course provides students with an introduction to the industrial environment. This course also provides industrial knowledge and experience for students. Students are actively involved in activities and real projects in the industry and make industrial internship reports.
Semester 6			
1.	Mata Kuliah	:	**Final Project**
	Kode	:	EM611
	SKS	:	6
	Deskripsi Mata Kuliah	:	This course is designed to direct students in preparing the Final Project as one of the requirements for student graduation. The Final Project is in the form of a scientific paper or project report compiled based on the results of observations and research from projects conducted by students during internships or cooperative education in the Industry. The preparation of the Final Project is based on the guidelines for preparing the project or final project. This course has a role in monitoring the Final Project work carried out by students carefully with the guidance of the supervisor.
2.	Mata Kuliah	:	**Cooperative Education**
	Kode	:	EM612
	SKS	:	14
	Deskripsi Mata Kuliah	:	This cooperative education course provides industrial knowledge and experience for students and students are also actively involved in real activities and projects in the industry and make a final report.