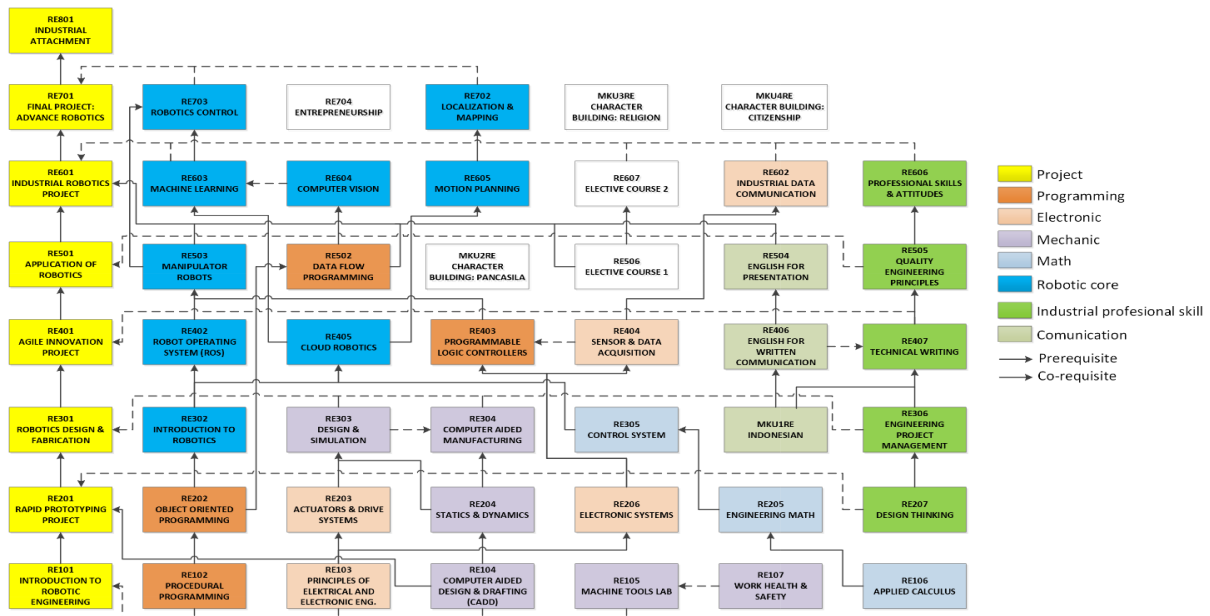**Kampus Merdeka**
INDONESIA JAYA

polibatam

Politeknik Negeri Batam
Pusat Pengembangan Pembelajaran dan Penjaminan Mutu

Silabus Mata Kuliah
Program Studi

TEKNIK ROBOTIKA

Tahun : 2021

SILABUS MATAKULIAH

No.	Komponen Silabus		Deskripsi
1.	Mata Kuliah	:	Introduction to Robotics Engineering
	Kode	:	RE101
	SKS	:	3
	Deskripsi Mata Kuliah	:	As a student of Robotics Engineering, you are part of the engineering profession. In this course, you will develop your identity as a modern engineer who will collaboratively contribute to the society. This course will provide the framework for engineering practice in product, process, and system building, and introduces essential personal and interpersonal skills. Students engage in the practice of engineering through a simple robotics project as a team. Utilization of C programming language, computer-aided design (CAD) software, and the microcontroller-based robotic control system into the project will help students to build prototypes. Students will asked to demonstrate critical thinking, creativity, and problem-solving skills in hands-on lab experiences.
2.	Mata Kuliah	:	Procedural Programming
	Kode	:	RE102
	SKS	:	3
	Deskripsi Mata Kuliah	:	Students will learn the fundamentals of programming in the C programming language, including iteration, decision branching, data types and expression. Students will use a microcontroller platform to implement C programming code.
3.	Mata Kuliah	:	Principles of Electrical and Electronic Engineering
	Kode	:	RE103
	SKS	:	3
	Deskripsi Mata Kuliah	:	Students learn electrical and electronics principles and instrument to measure the parameters. DC fundamentals include sources, resistance, Ohm's and Kirchhoff's Laws with simple circuits, diode, transistor and FET. AC systems include transformers and reactive elements, power production and distribution, filtering, motors and relays. Digital Electronics: Perform basic binary arithmetic calculations; analyze and synthesize combinatorial logic circuits;
4	Mata Kuliah	:	Computer Aided Design and Drafting
	Kode	:	RE104
	SKS	:	3

	Deskripsi Mata Kuliah	:	Introduces the use of computer-aided design & drafting (CADD) software to create 3D models complete with detailed documentation such as dimensions, materials used and even details the design process. Topics include blue print reading, orthographic projection, sectioning, assembly drawing and basic solid modelling.
5	Mata Kuliah	:	Machine Tools Lab
	Kode	:	RE105
	SKS	:	3
	Deskripsi Mata Kuliah	:	Students will demonstrate their abilities to interpret drawings and select the appropriate equipment needed to produce each part. Parts built will be inspected by the student to verify the meeting of part requirements. Students will repair/replace any parts that are found to be out of specifications. Inspection tools will be utilized in the product validation requirement of the course. Topics will be experimentally validated through the creation of mechanical parts that will be assembled into a final product.
6	Mata Kuliah	:	Applied Calculus
	Kode	:	RE106
	SKS	:	3
	Deskripsi Mata Kuliah	:	Utilization of differential and integral calculus, as a minimum, to characterize the static and dynamic performance of robotics systems. Course topics including determinant, matrices, vectors, trigonometry, complex numbers, limits, derivative, integrals, differential equation, and Laplace transformations.
7	Mata Kuliah	:	Work Health and Safety
	Kode	:	RE107
	SKS	:	2
	Deskripsi Mata Kuliah	:	This course has been developed to provide an understanding of health and safety responsibilities in the workplace, how risk is managed in the workplace using the risk management process, and what you should expect to find in the workplace to help you work safely.
8	Mata Kuliah	:	Rapid Prototyping Project
	Kode	:	RE201
	SKS	:	3
	Deskripsi Mata Kuliah	:	Equip students with a deep design thinking skills of ideation, prototyping, and iteration. Consistently generate more and better ideas by using CDIO approach to brainstorming and ideation. Lowering a risk by running small experiments to learn from failure in a controlled environment. Create a culture of experimentation on a team and expand students capacity for innovation.
9	Mata Kuliah	:	Object Oriented Programming
	Kode	:	RE202
	SKS	:	3
	Deskripsi Mata Kuliah	:	This course introduces the concepts of object-oriented programming to students with a background in the procedural programming paradigm. The course begins with a brief review of control structures, data types and array processing. It then moves on to introduce the object-oriented programming paradigm, focusing on the definition and use of classes along with the fundamentals of object-oriented design. Other topics include an overview of programming language principles, simple analysis of algorithms, basic searching and sorting techniques, memory management, an introduction to software engineering issues, and ethics in software development.
10	Mata Kuliah	:	Actuators and Drive Systems
	Kode	:	RE203
	SKS	:	3

	Deskripsi Mata Kuliah	:	This course introduces actuators and drive system for both of pneumatics & hydraulic actuators and electric actuators. Course topics including a study of fluid power technology using fluids or compressed air as the transfer media. Complete hydraulic and pneumatic systems are studied, including power sources, reservoirs, pumps, compressors, lines, valves and actuators. Troubleshooting strategies to identify, localize and correct malfunctions. Preventative maintenance and safety issues will also be discussed. Introduction of power electronic drives with motors includes electromagnetic and energy conversion, amplifiers, motors, relays, power systems, application specific selection of machinery and drive systems.
11	Mata Kuliah	:	Statics and Dynamics
	Kode	:	RE204
	SKS	:	3
	Deskripsi Mata Kuliah	:	This course studies how to perform static calculations on objects and what physical factors affect these objects as well as the concept of rigid body motion analysis and dynamic systems and modeling of robotic systems.
12	Mata Kuliah	:	Engineering Math
	Kode	:	RE205
	SKS	:	3
	Deskripsi Mata Kuliah	:	This course discusses how to solve mathematical problems such as systems of linear, nonlinear, derivative, integral, differential and interpolation equations using a numerical method approach. In addition, it also discusses basic statistics and Bayesian probabilities.
13	Mata Kuliah	:	Electronic Systems
	Kode	:	RE206
	SKS	:	3
	Deskripsi Mata Kuliah	:	Students learn electronics systems, their basic performance and applications. Computer systems are presented with a microcontroller and provide the ability to write and read both digital and analog data. Analog systems include diodes, transistors, IC amplifiers, and analog-digital and digital to analog conversions. The semester closes by combining all of the topics presented in the control of motor speed.
14	Mata Kuliah	:	Design Thinking
	Kode	:	RE207
	SKS	:	2
	Deskripsi Mata Kuliah	:	Student will engage in critical analysis of real-world problems and global challenges. They will demonstrate the ability to recognize opportunity and to take initiative in developing solutions applying the principles of human centered design, local and global impact of engineering solutions on individuals, organizations and society. Students will be able to communicate effectively and to work well on teams. Problems and solutions will be examined from societal, cultural, and ethical perspectives.
15	Mata Kuliah	:	Robotics Design & Fabrication
	Kode	:	RE301
	SKS	:	3
	Deskripsi Mata Kuliah	:	Design and construct a simple robotics system that integrates the mechanical, electrical, electronics and programming into a working product. In the process of designing, building and fabricating the product, students will integrate knowledge of mechanical system design, computer aided design (CAD), basic electrical and electronics learnt in other modules. Various aspects of personal and interpersonal skills such as teamwork, communications, as

			well as managing learning are systematically infused in carrying out the design-fabricate project.
16	Mata Kuliah	:	Introduction to Robotics
	Kode	:	RE302
	SKS	:	3
	Deskripsi Mata Kuliah	:	This course introduces the fundamental concepts of robotics with emphasis on hands-on experience in programming and application of various robots. Topics covered include introduction of robotics, robot classifications, robot programming, safety considerations, sensors, motors, robot and system integration, and fundamentals of kinematics. Students will get hands-on experience with building robots, integrating sensors and actuators, and developing algorithms for robot control. It is an explicit goal of this course to advance students' critical thinking and communication skills. This is achieved through laboratories, group work, and discussions.
17	Mata Kuliah	:	Design and Simulation
	Kode	:	RE303
	SKS	:	3
	Deskripsi Mata Kuliah	:	This course introduces standard part, robot mechanism, ergonomic, product design, dynamic simulation in CAD software.
18	Mata Kuliah	:	Computer Aided Manufacturing
	Kode	:	RE304
	SKS	:	3
	Deskripsi Mata Kuliah	:	The course focuses on CNC milling as a manufacturing automation process applied to a project. Course provides knowledge of computer-aided machining in milling and turning, including process planning techniques, machine coding and operational instructions to produce precision components. Manufacturing management and system skills, such as product planning, manufacturing sequence, time and cost are also discussed. Student also learn how to effectively present the ideas and outcomes using oral and report based methods.
19	Mata Kuliah	:	Control System
	Kode	:	RE305
	SKS	:	3
	Deskripsi Mata Kuliah	:	An introduction to the analysis and design of linear feedback control systems. The course will include a study of introduction to control system, mathematical model of system, state variable model, root locus, design of feedback control system, steady-state analysis, time response analysis, digital control system. Laboratory exercises will develop a student's ability to design feedback systems and quantify system performance.
20	Mata Kuliah	:	Engineering Project Management
	Kode	:	RE306
	SKS	:	2
	Deskripsi Mata Kuliah	:	This course provides students with the skills necessary for successful completion of their design project. Topics include group dynamics, ethics, timelines, resource allocation, project management and performance evaluations. Skills in oral and written communications, problem conceptualization, creative problem solving and technical presentations are developed.
21	Mata Kuliah	:	Indonesian
	Kode	:	PK4RE
	SKS	:	2
	Deskripsi Mata Kuliah	:	In this course Students will explore lecture materials including: (a) academic ethics and differences proper type and systematics of scientific writing; (b) the Indonesian formulation used in the scientific writings with due observance of grammatical principles, PUEBI, and KBBI; (c) reference related to scientific writing; (d) the

			accuracy of the Indonesian language formulation in writing scientific papers; (e) accuracy the use of the Indonesian language formulation properly and correctly in the preparation of scientific papers; (f) skilled in conveying the results of ideas / ideas orally including presentation techniques. (g) able to write e-mails effectively, technical reports, and instruction manuals.
22	Mata Kuliah	:	Agile Innovation Project
	Kode	:	RE401
	SKS	:	3
	Deskripsi Mata Kuliah	:	Equip students with agile methodology to create innovative products or solutions. Students collaborate in multi-disciplinary groups to define, design, build, test and release products.
23	Mata Kuliah	:	Robot Operating System (ROS)
	Kode	:	RE402
	SKS	:	3
	Deskripsi Mata Kuliah	:	The course provides an application-specific introduction to the robotics operating system (ROS) to provide practicing engineers in developing a robotic application. Topics include what ROS is, basic concepts of ROS, nodes, topics, services, actions, and parameters. Use ROS to inspect and debug a robotics system, prototype simple command and control applications for a simulated mobile robot, integrate a new sensor into the robot's ROS ecosystem and make use of sensor data to inform a robot's mission in real-time. In addition, this course will discuss about robot modeling using ROS and Gazebo.
24	Mata Kuliah	:	Programmable Logic Controllers
	Kode	:	RE403
	SKS	:	3
	Deskripsi Mata Kuliah	:	This course examines the concepts, devices, and common practices associated with modern industrial control systems. Common industrial control devices are studied. Students learn how to wire, program, and troubleshoot programmable logic controller (PLC) based control systems. PLC applications focus on interfacing and controlling a variety of electromechanical devices such as motors and pneumatic actuators. Industrial safety practices and procedures are emphasized throughout the course.
25	Mata Kuliah	:	Sensor and Data Acquisition
	Kode	:	RE404
	SKS	:	3
	Deskripsi Mata Kuliah	:	This course introduce a microprocessor-based techniques for data acquisition and processing, including sensors, sensor fusion, interfacing, sampling, reconstruction, and computer communications. Signal processing based on error analysis and statistics.
26	Mata Kuliah	:	Cloud Robotics
	Kode	:	RE405
	SKS	:	3
	Deskripsi Mata Kuliah	:	This course explains cloud technology and its application in the field of robotics. Materials that will be discussed in this course include machine to machine and machine to cloud communication. The cloud robotic architecture leverages the combination of an ad-hoc cloud formed by machine-to-machine (M2M) communications among participating robots, and an infrastructure cloud enabled by machine-to-cloud (M2C) communications.
27	Mata Kuliah	:	English for Written Communication
	Kode	:	RE406
	SKS	:	2
	Deskripsi Mata Kuliah	:	This course introduce to students to write clear and positive messages and to understand basic writing strategies. The subject

			matter of this course includes some of the typical techniques for effective writing and will give students practice in writing a wide variety of email messages, memos, letters, scientific papers and workplace reports.
28	Mata Kuliah	:	Technical Writing
	Kode	:	RE407
	SKS	:	2
	Deskripsi Mata Kuliah	:	Provides knowledge of and practice in technical writing. Key topics include audience analysis; organizing, preparing and revising short and long technical documents; designing documents using effective design features and principles, and formatting elements using tables and graphs; conducting research; writing technical definitions, and physical and process descriptions; writing instructions; and individual and group peer editing.
29	Mata Kuliah	:	Application of Robotics
	Kode	:	RE501
	SKS	:	3
	Deskripsi Mata Kuliah	:	This project equip student with knowledge of commonly used robots, their applications, robot safety, and basic robot programming methods. The objective of the course is to equip students with fundamental knowledge on robots. Students will be aware of benefits of using robots, able to perform basic robot programming, and able to select suitable robots and associated components for different applications.
30	Mata Kuliah	:	Data Flow Programming
	Kode	:	RE502
	SKS	:	3
	Deskripsi Mata Kuliah	:	This course students will learn concept of data flow programming using LabVIEW. Course topics including programming concepts, techniques, features, VIs, and functions you can use to create test and measurement, data acquisition, instrument control, data logging, measurement analysis, and report generation applications. This course designed to build students proficiency with LabVIEW and help them to prepare for the NI Certified LabVIEW Associate Developer exam.
31	Mata Kuliah	:	Manipulator Robots
	Kode	:	RE503
	SKS	:	3
	Deskripsi Mata Kuliah	:	This course discusses manipulator robots and related applications in industrial environments. This course will cover material related to homogeneous transformation, manipulator kinematics, and manipulator dynamics. Robot manipulator applications that will be discussed in this course include pick and place and packaging.
32	Mata Kuliah	:	English for Presentation
	Kode	:	RE504
	SKS	:	2
	Deskripsi Mata Kuliah	:	The aim of the course is to prepare students to present in English and deal with questions from the audience at international conferences and other events. The students will study and practice various aspects of giving academic presentations. They will learn the key strategies necessary to improve their communicativeness and fluency.
33	Mata Kuliah	:	Quality Engineering Principles
	Kode	:	RE505
	SKS	:	2
	Deskripsi Mata Kuliah	:	This course is designed to introduce the student to techniques required to maintain and improve quality within manufacturing organizations. The course covers concepts of quality, quality managements and assurance, product quality, design of quality

			control chart, statistical process control, and quality improvement through design by considering concept development and implementation. Student also introduced with Industry and engineering standards and codes, i.e IEC, FMEA, Six Sigma.
34	Mata Kuliah	:	Elective Course 1
	Kode	:	RE506
	SKS	:	3
	Deskripsi Mata Kuliah	:	This course provide elective topics i.e: mobile technology, augmented reality and/or virtual reality, or special topics related to robotics. Augmented reality and virtual reality: This course presents an introduction to augmented and virtual reality technologies, with an emphasis on designing and developing interactive virtual and augmented reality experiences. The course will cover the history of the area, fundamental theory, interaction techniques, and specific application areas. Concepts from the contributing fields of computer vision, computer graphics and human computer interaction will be introduced in the context of virtual and augmented reality. Students will be tasked with creating their own virtual or augmented reality application as a course project.
35	Mata Kuliah	:	Character Building: Pancasila
	Kode	:	PK2RE
	SKS	:	2
	Deskripsi Mata Kuliah	:	Students gain knowledge and learning experience to improve understanding and awareness about: a sense of nationality and love for the homeland through insights about Pancasila so that they become citizens who have competitiveness, and are highly disciplined and actively participate in building a peaceful life based on a value system Pancasila. After this lecture, it is hoped that students will be able to manifest themselves as citizens a good country that is able to support the nation and state. Smart citizen, civilized and responsible for the survival of the Indonesian state in practicing their knowledge, technology and art abilities.
36	Mata Kuliah	:	Industrial Robotics Project
	Kode	:	RE601
	SKS	:	3
	Deskripsi Mata Kuliah	:	This project focuses on the role of robots in increasing safety, productivity and profit for specific industries: manufacturing, medical, services, entertainment & military. A cost analysis of industry robot integration is provided supporting a positive increase in tasks performance and reduction of operational costs.
37	Mata Kuliah	:	Industrial Data Communication
	Kode	:	RE602
	SKS	:	3
	Deskripsi Mata Kuliah	:	This course will expose the students to many of the different Industrial Networks that will be encountered in a manufacturing setting. Students will gain an understanding of the network infrastructure utilized by industrial machinery and the communication profiles used. The communication profiles will include but not be limited to: Serial Communication, RS-232, Ethernet, Modbus, Profibus, DevicNet, Foundational Fieldbus and AS-I Bus.
38	Mata Kuliah	:	Machine Learning
	Kode	:	RE603
	SKS	:	3
	Deskripsi Mata Kuliah	:	Machine learning (ML) algorithms are used to extract and analyze large amounts of manufacturing data. Fundamental ML analytic techniques and commonly used ML algorithms for manufacturing

			applications will be introduced. Students will create, train, and deploy ML models on a cloud platform to create enterprise-ready smart manufacturing artificial intelligence (AI) solutions. In this course we will learn about the basics of deep neural networks, and their applications to various AI tasks. By the end of the course, it is expected that students will have significant familiarity with the subject, and be able to apply Deep Learning to a variety of tasks. They will also be positioned to understand much of the current literature on the topic and extend their knowledge through further study.
39	Mata Kuliah	:	Computer Vision
	Kode	:	RE604
	SKS	:	3
	Deskripsi Mata Kuliah	:	This course provides fundamental knowledge of integrated computer imaging or vision systems for sensing, quality control and robotics applications. Fundamental basis of optics, illumination, camera types with associated technologies, and image acquisition to develop a customized computer imaging or vision systems will be covered. Algorithms for image processing, image analysis and pattern recognition will also be covered.
40	Mata Kuliah	:	Motion Planning
	Kode	:	RE605
	SKS	:	3
	Deskripsi Mata Kuliah	:	This course discusses various algorithms regarding robot movement planning, such as the A*, djikstra, RRT algorithm and also discusses optimization methods, which are methods to find the most optimal value of a problem. Optimization methods that will be discussed include genetic algorithms, particle swarm optimization, prohibition search and the Monte Carlo method.
41	Mata Kuliah	:	Professional Skills and Attitudes
	Kode	:	RE606
	SKS	:	2
	Deskripsi Mata Kuliah	:	This course introduce professional ethics, integrity, responsibility and accountability, professional behavior, proactively planning for one's career, and stay current on world of engineer.
42	Mata Kuliah	:	Elective Course 2
	Kode	:	RE607
	SKS	:	3
	Deskripsi Mata Kuliah	:	This elective course gives students the opportunity to choose courses on specific topics: Mobile Robots, Legged Robots, Medical Robots, Flying Robots and other topics.
43	Mata Kuliah	:	Final Project : Advanced Robotics
	Kode	:	RE701
	SKS	:	4
	Deskripsi Mata Kuliah	:	This is the capstone project, a design experience for senior level students in robotic engineering. In this project student teams will design, build and test solutions to real-world problem. Students will work with advanced topics in robotics i.e.: motion planning, positioning, teleoperation, control, navigation, human-robot interaction.
44	Mata Kuliah	:	Localization and Mapping
	Kode	:	RE702
	SKS	:	3
	Deskripsi Mata Kuliah	:	This course discusses the technique for creating an environment map and determining the robot pose relative to a given map of the environment. The localization algorithms that will be discussed are Extended Kalman Filter (EKF), Unscented Kalman Filter (UKF), and Monte Carlo Localization (MCL). Moreover, the occupancy grid mapping algorithm will be explained for map creation.

45	Mata Kuliah	:	Robotics Control
	Kode	:	RE703
	SKS	:	3
	Deskripsi Mata Kuliah	:	This course introduces a Behavior Tree, Finite State Machine (FSM), LQR, Linier System robotic controller system. Student also equipped a proper chosen of robotic controller system which is suitable with the project related to robotics in real application.
46	Mata Kuliah	:	Entrepreneurship
	Kode	:	RE704
	SKS	:	2
	Deskripsi Mata Kuliah	:	This course introduces engineering students to the concepts and practices of technology entrepreneurial thinking and entrepreneurship. Using lectures, case studies, business plans, and student presentations, the course teaches life skills in entrepreneurial thought and action that students can utilize in starting technology companies or executing R&D projects.
47	Mata Kuliah	:	Character Building: Religion
	Kode	:	PK1RE
	SKS	:	2
	Deskripsi Mata Kuliah	:	This Islamic Religious Education course discusses and explores materials with the substance of human relations with God to create a pious generation with the Qur'anic paradigm; human relations with fellow human beings in order to integrate Faith, Islam and Ihsan; and the relationship between humans and their environment in the context of grounding Islam to realize prosperity. Thus, a religious, humanist, broad-minded and caring generation was born.
48	Mata Kuliah	:	Character Building: Citizenship
	Kode	:	PK3RE
	SKS	:	2
	Deskripsi Mata Kuliah	:	The Citizenship course discusses and explores knowledge and skills learning experiences to increase understanding and awareness of: a sense of nationality and love for the homeland, civilized democracy, become a citizen with personality Indonesia is competitive, disciplined and actively participates in building peaceful life based on the Pancasila value system. Able to manifest yourself into good citizens who are able to support the nation and state, citizens who democratic, namely citizens who are intelligent, civilized and responsible for survival of the Indonesian state in practicing the ability of science, technology and art.
49	Mata Kuliah	:	Industrial Attachment
	Kode	:	RE801
	SKS	:	20
	Deskripsi Mata Kuliah	:	Giving students valuable industry experience. Introduce students to industry culture and train the future workforce and industry leadership, enhance their studies, and gain from unique professional development opportunities.