



# UNIVERSITAS GADJAH MADA

Faculty of Mathematics and Natural Sciences

Department of Computer Science and Electronics

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## Bachelor in Electronics and Instrumentation

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## MODULE HANDBOOK

Module name	: <b>Microcontroller (IUP)</b>
Module level, if applicable	: Undergraduate
Code, if applicable	: MII1307
Courses, if applicable	
Semester(s) in which the module is taught	
Person responsible for the module	: Agfianto Eko Putra, Dr., M.Si.
Lecturer(s)	: Agfianto Eko Putra, Dr., M.Si.
Language	: English
Relation to curriculum	: Elective Course
Teaching methods	: Student Centered Learning
Workload (incl. contact hours, self-study hours)	: 42 contact hours, 42 self-study hours
Credit points	: 3
Requirements according to the examination regulations	: Minimum attendance at lectures is 75% (according to UGM regulation). Final score is evaluated based on assignments (20%), mid semester exam (40%), and end semester exam (40%).
Required and recommended prerequisites for joining the module	: basic electronics and programming
Learning outcomes and their corresponding PLOs	After completing this module, a student is expected to: CO1. Explains microcontrollers in general and ESP32 microcontrollers in particular, including the ESP32 inputs outputs, PWM, analogue inputs, interrupt timer and deep sleep feature CO2. Understand and can program the basic concept of ESP32 features, including ESP32 Hall sensor, touch sensor, I2C, flash memory and dual-core capability, also interfacing with OLED display. CO3. Understand the basic concepts of interfacing and programming ESP32 with sensors, including DHT11/DHT22, DS18B20, BME280, BMP180 and MPU6050. CO4. Understand the basic concepts of ESP32 and protocols in the Internet of Things (IoT), including HTTP, MQTT and BLE. CO.5 Understand the basic concepts of some applications using ESP32

PLO		CO1	CO2	CO3	CO4	CO5
Program Learning Outcome (PLO)	<b>PLO1</b>					
	<b>PLO2</b>	√	√	√	√	
	<b>PLO3</b>	√	√	√	√	
	<b>PLO4</b>					√
	<b>PLO5</b>					

Content

1. Introduction to Microcontroller and ESP32
  - a. Introduction to Microcontrollers and ESP32
  - b. Arduino IDE platform software
  - c. ESP32 I/O
  - d. ESP32 Pulse Width Modulation
  - e. ESP32 analogue input
  - f. ESP32 interrupt timer
  - g. ESP32 Deep Sleep
2. ESP32 features
  - a. ESP32 Hall Sensors
  - b. ESP32 touch sensor
  - c. I2C serial communication on ESP32
  - d. ESP32 Flash Memory
  - e. ESP32 Dual Core
3. Operate important sensors
  - a. DHT11/DHT22 temperature and humidity sensors
  - b. DS18B20 temperature sensor
  - c. MPU-6050 Accelerometer Gyroscope sensor
  - d. Mini PIR sensor AM312
  - e. BMP180 Barometric sensor
  - f. ESP32 MicroSD Card
4. Internet of Things concept and protocols
  - a. IoT Introduction
  - b. ESP32 Wi-Fi
  - c. ESP32 Web Server
  - d. ESP32 MQTT
  - e. ESP32 Bluetooth
5. ESP32 Application (case study)
  - a. DHT Web Server
  - b. DS18B20 Web Server
  - c. RGB LED Web Server
  - d. MPU-6050 Web Server
  - e. Telegram Control Outputs
  - f. Telegram Sensor Readings
  - g. Telegram Detect Motion

Study and examination requirements and

examination forms																																				
Media employed	: slides, discussion, online or offline meeting																																			
Assessments and evaluation	<table border="1"> <thead> <tr> <th>Type</th> <th>Percentage</th> <th>CO1</th> <th>CO2</th> <th>CO3</th> <th>CO4</th> <th>CO5</th> </tr> </thead> <tbody> <tr> <td>Assignments/Quiz</td> <td>20</td> <td>✓</td> <td>✓</td> <td>✓</td> <td>✓</td> <td>✓</td> </tr> <tr> <td>Midterm exam</td> <td>40</td> <td>✓</td> <td>✓</td> <td>✓</td> <td></td> <td></td> </tr> <tr> <td>Final exam</td> <td>40</td> <td></td> <td></td> <td></td> <td>✓</td> <td>✓</td> </tr> <tr> <td>Total</td> <td>100</td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> </tbody> </table>	Type	Percentage	CO1	CO2	CO3	CO4	CO5	Assignments/Quiz	20	✓	✓	✓	✓	✓	Midterm exam	40	✓	✓	✓			Final exam	40				✓	✓	Total	100					
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Reading list	[1] Santos, Rui, 2023, <b>160+ ESP32 Projects, Tutorials and Guides with Arduino IDE</b> , Random Nerd Tutorials ( <a href="https://randomnerdtutorials.com/projects-esp32/">https://randomnerdtutorials.com/projects-esp32/</a> )																																			

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