DEPARTMENT OF TECHNOLGY EDUCATION,IER
UNIVERSITY OF THE PUNJAB, LAHORE-PAKISTAN
Course Outline

Programme	BS Technology Education	Course Code	BSTE317	Credit Hours	3
Course Title	Internet of Things (IoT) Hardware Development				

Course Introduction
The Internet of Things (IoT) Hardware Development course provides a comprehensive understanding of the principles, technologies, and methodologies involved in designing and developing IoT hardware. This course covers the basics of IoT, sensor integration, microcontroller programming, communication protocols, and power management. Students will gain hands-on experience through practical projects and assignments.

Learning Outcomes
On the completion of the course, the students will: 1. Understand the fundamental concepts of IoT and its applications.   2. Design and develop IoT hardware systems.   3. Integrate sensors and actuators with microcontrollers.   4. Implement communication protocols for IoT devices.   5. Optimize power management in IoT devices.   6. Develop and troubleshoot IoT prototypes.

Course Content		Assignments/Readings
Week 1	**Introduction to IoT** **Unit 1.1**: Overview of IoT	Reflective essay on the impact of IoT on modern technology
	Unit 1.2: IoT Applications	
Week 2	**IoT Hardware Components** **Unit 2.1**: Sensors and Actuators	Identify and describe the function of different sensors and actuators
	Unit 2.2: Microcontrollers and Development Board	
Week 3	**Microcontroller Basics** **Unit 3.1**: Introduction to Microcontrollers	Research and write a report on a popular microcontroller (e.g., Arduino, ESP8266)
	Unit 3.2: Microcontroller Programming	
Week 4	**Interfacing Sensors and Actuators** **Unit 4.1**: Digital and Analog Interfacing	Interface a sensor and an actuator with a microcontroller
	Unit 4.2: Data Acquisition and Processing	

Week	Topic / Units	Activity
Week 5	**Communication Protocols for IoT** **Unit 5.1**: Overview of Communication Protocols **Unit 5.2**: Implementing Communication Protocols	Research and present on different IoT communication protocols (e.g., MQTT, HTTP, CoAP)
Week 6	**Networking and Connectivity** **Unit 6.1**: Wi-Fi and Bluetooth Connectivity **Unit 6.2**: Low-Power Wide-Area Networks (LPWAN)	Set up Wi-Fi and Bluetooth communication for an IoT device
Week 7	**IoT Platforms and Ecosystems** **Unit 7.1**: Introduction to IoT Platforms **Unit 7.2**: Integrating IoT Devices with Cloud Platforms	Explore and compare popular IoT platforms (e.g., AWS IoT, Google Cloud IoT)
Week 8	**Power Management in IoT Devices** **Unit 8.1**: Power Consumption and Optimization **Unit 8.2**: Energy Harvesting Techniques	Measure and optimize the power consumption of an IoT device
Week 9	**IoT Security and Privacy** **Unit 9.1**: Security Challenges in IoT **Unit 9.2**: Implementing Security Measures	Write a report on common security challenges in IoT
Week 10	**Edge Computing and IoT** **Unit 10.1**: Introduction to Edge Computing **Unit 10.2**: Implementing Edge Computing Solutions	Research and present on the role of edge computing in IoT
Week 11	**Real-Time Operating Systems (RTOS) for IoT** **Unit 11.1**: Introduction to RTOS **Unit 11.2**: Implementing RTOS in IoT Projects	Research and present on the benefits of using RTOS in IoT devices
Week 12	**Case Studies and Industry Applications** **Unit 12.1**: Case Studies of Successful IoT Projects **Unit 12.2**: Industry Applications of IoT	Analyze a case study of an IoT project
Week 13	**Prototyping and Testing** **Unit 13.1**: IoT Prototyping Techniques **Unit 13.2**: Testing and Debugging IoT Devices	Develop a prototype for an IoT application
Week 14	**Final Project Development**	Develop a comprehensive

	Unit 14.1: Project Planning and Design	project proposal for an IoT application
	Unit 14.2: Project Implementation	
Week 15	**Final Project Completion** **Unit 15.1**: Project Development and Testing	Complete and test the final IoT project
	Unit 15.2: Project Presentation	
Week 16	**Course Review and Final Assessment** **Unit 16.1**: Review of Key Concepts and Themes	Group presentation summarizing key learnings from the course
	Unit 16.2: Comprehensive Final Exam	

Textbooks and Reading Material

1. Textbooks.

   o Internet of Things: Principles and Paradigms edited by Rajkumar Buyya and Amir Vahid Dastjerdi

2. Suggested Readings

   o Building the Internet of Things: Implement New Business Models, Disrupt Competitors, Transform Your Industry by Maciej Kranz

Teaching Learning Strategies

1. **Lectures:** To introduce and explain key concepts and theories.
2. **Hands-on Labs:** To provide practical experience with robotics components and programming.
3. **Assignments and Projects:** To reinforce learning and encourage application of concepts in real-world scenarios.
4. **Guest Lectures:** To provide insights from industry experts and professionals.

Assessment

Sr. No.	Elements	Weight age	Details
1.	Midterm Assessment	35%	Written Assessment at the mid-point of the semester.
2.	Formative Assessment	25%	Continuous assessment includes: Classroom participation, assignments, presentations, viva voce, attitude and behavior, hands-on-activities, short tests, projects, practical, reflections, readings, quizzes etc.

3.	Final Assessment	40%	Written Examination at the end of the semester. It is mostly in the form of a test, but owing to the nature of the course the teacher may assess their students based on term paper, research proposal development, field work and report writing etc.