

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

Programme	BS Technology Education	Course Code	BSTE324	Credit Hours	3
Course Title	Fundamentals of Robotics: Basics to Industry Applications				
Course Introduction					
This course offers a comprehensive introduction to the field of robotics, covering fundamental concepts, essential technologies, and their applications in various industries. It is designed for students and professionals who are interested in understanding the basics of robotics and how these principles are applied in real-world scenarios.					
Learning Outcomes					
On the completion of the course, the students will: 1. Understand the fundamental concepts of robotics. 2. Describe the components and functions of robotic systems. 3. Apply basic programming skills to control robotic systems. 4. Analyze and design simple robotic mechanisms. 5. Evaluate the application of robotics in different industrial sectors. 6. Develop problem-solving skills in the context of robotics engineering.					
Course Content				Assignments/Readings	
Week 1	Introduction to Robotics • Unit 1.1: History and Evolution of Robotics			Search and present the history of a specific robot.	
	• Unit 1.2: Key Concepts and Definitions				
Week 2	Robotics Components • Unit 2.1: Sensors and Actuators			Identify and describe the function of various sensors and actuators in a robot	
	• Unit 2.2: Control Systems				
Week 3	Kinematics and Dynamics • Unit 3.1: Forward and Inverse			Solve kinematics problems	

	Kinematics	for a simple robotic arm.
	• Unit 3.2: Dynamics of Robotic Systems	
Week 4	Robotics Programming • Unit 4.1: Introduction to Robotics Programming Languages	Write a basic program to control a robot's movements.
	• Unit 4.2: Basic Programming for Robot Control	
Week 5	Robot Perception and Vision • Unit 5.1: Introduction to Machine Vision	Implement a simple image processing algorithm.
	• Unit 5.2: Image Processing Techniques	
Week 6	Robotic Manipulators • Unit 6.1: Types of Manipulators	Design a simple manipulator and analyze its motion.
	• Unit 6.2: Manipulator Design and Analysis	
Week 7	Mobile Robotics • Unit 7.1: Types of Mobile Robots	Develop a basic navigation algorithm for a mobile robot.
	• Unit 7.2: Navigation and Path Planning	
Week 8	Industrial Robotics Applications • Unit 8.1: Robotics in Manufacturing	Case study analysis of robotics applications in a chosen industry.
	• Unit 8.2: Robotics in Healthcare	
Week 9	Human-Robot Interaction • Unit 9.1: Principles of Human-Robot Interaction	Discuss the ethical implications of robots in society.
	• Unit 9.2: Safety and Ethical Considerations	
Week 10	Advanced Robotics Programming • Unit 10.1: Advanced Programming	Develop and debug a complex robot control

	Techniques	program.
	• Unit 10.2: Simulation and Debugging	
Week 11	Artificial Intelligence in Robotics • Unit 11.1: Introduction to AI and Machine Learning	Implement a basic machine learning algorithm for a robotic task
	• Unit 11.2: AI Applications in Robotics	
Week 12	Collaborative Robots (Cobots) • Unit 12.1: Introduction to Cobots	Design a workflow incorporating cobots for a specific task.
	• Unit 12.2: Cobots in Industry	
Week 13	Robotics and Automation • Unit 13.1: Principles of Automation	Create a plan for automating a manufacturing process using robots.
	• Unit 13.2: Integration of Robotics in Automated Systems	
Week 14	Robotics in Service Industries • Unit 14.1: Robots in Retail and Hospitality	Analyze the impact of robots in a chosen service industry.
	• Unit 14.2: Robots in Education and Entertainment	
Week 15	Current Trends and Research in Robotics • Unit 15.1: Emerging Technologies and Innovations	Review and present a recent research paper on robotics
	• Unit 15.2: Recent Research and Developments	
Week 16	Future of Robotics • Unit 16.1: Future Trends and Predictions	Write a reflective essay on the future of robotics and potential career paths
	• Unit 16.2: Career Opportunities in Robotics	
Textbooks and Reading Material		

1. Textbooks.

1. Introduction to Robotics: Mechanics and Control by John J. Craig

2. Suggested Readings

- Robotics: Modelling, Planning and Control by Bruno Siciliano, Lorenzo Sciavicco, Luigi Villani, Giuseppe Oriolo
- Programming Robots with ROS: A Practical Introduction to the Robot Operating System by Morgan Quigley, Brian Gerkey, and William D. Smart
- Selected research papers and articles from journals such as IEEE Transactions on Robotics, Robotics and Autonomous Systems, and the International Journal of Robotics Research.

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. **Group Discussions:** To facilitate peer learning and collaborative problem-solving.
5. **Guest Lectures:** To provide insights from industry experts and professionals.
6. **Case Studies:** To analyze and learn from real-world robotics applications and scenarios.

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.