Module (Course Syllabus) Catalogue

2023-2024

College/ Institute	**Erbil Technology College**	
Department	**Department of AITE**	
Module Name	**Applied Industrial Robotic**	
Module Code	**AIR 806**	
Semester	**8**	
Credits	**4**	
Module type	**Core**	
Weekly hours	**4**	
Weekly hours (Theory)	**(2)hr Class**	**(86)hr Workload**
Weekly hours (Practical)	**(2)hr Class**	**(86)hr Workload**
Lecturer (Theory)	**Farah A. Abed**	
E-Mail & Mobile NO.	**Farah.abed@epu.edu.iq 07503527165**	
Lecturer (Practical)	**Farah A. Abed**	
E-Mail & Mobile NO.	**Farah.abed@epu.edu.iq 07503527165**	

Course Book

Course Description	This is the 8th semester in Applied Industrial Robotics. Students will learn about specific areas of application and the industrial robotics is becoming popular in areas traditionally occupied by industrial automation. The course will cover the history of robotics, anatomy, mechanics, their structure, operation and controls in automation. Students will also learn the types of robot and sensors that governing the operation of it, and applications in industrial.
Course objectives	The course is prepared for final class students. It's highlighting on Industrial Robotic, and its characteristics. To enlighten the students about the fundamentals of robotic systems. • To familiarize the students with the fundamentals of sensors and various drive systems. • To execute knowledge about basics of kinematic of robot manipulators.
Student's obligation	**Respect** A student has an obligation to exhibit honesty and to respect the ethical standards of the profession in carrying out his/her academic assignments. Without limiting the application of this principle. **Attendance** Missed classes will not be compensated including the quizzes and the scheduled assignments. The students will lose marks on unattended classes with quizzes unless a legal document or authorized leave is presented which should explain the excuse of the absence. However, the absent student should take the responsibility for making up the missed lecture. **The lectures format** The lectures are divided on four weekly hours (two hours theoretically and two hours practically). Mainly, the first two theoretical hours will be dedicated for the topic backgrounds and the main principles. Notes and handouts are given to the students containing the detail of the theoretical topics. Theoretical lectures will be assisted by presentations using white board and data show. Discussion time is provided for the students for questions. The first practical hour will be dedicated for how to works in the laboratory, health and safety, how to use equipment, boards, components, and wire connection to do experiments and reports. Students should submit every week a report about the previous experiment.

	Questions Asking questions about unclear material is an important part of the classroom experience. It is not uncommon for students to have similar difficulties, so speaking up will help everyone understand the discussed information. Teachers can also benefit from a student's questions. By finding out what subjects are hard to understand, instructors can adjust their lectures to clear up confusing topics. **Assignment** A student must submit the assignment on **moodle** app. every week and also write a report about what he/she was studied in the laboratory.
Assessment scheme	16% Mid Term (Theory and practical) 4% Quiz 40% Assignment (report, paper, homework, seminar...) 25% final practical 15% final theory
Specific learning outcome:	After taking this course, students have ability to: 1. Acquire basic knowledge on industrial robots. 2. Be able to select the suitable end effectors and vision systems for various applications. 3. Design and analyze the manipulators of robots. 4. Be able to develop the programmer and select the control system for robotic applications. 5. Select the appropriate robots for different industrial applications.
Course References:	1. Deb S.R, "Robotics Technology and flexible automation", Tata McGraw-Hill Education, 2nd Edition 2017. 2. Mikell P Groover& Nicholas G Odrey, Mitchel Weiss, Roger N Nagel, Ashish Dutta, Industrial Robotics, "Technology Programming and Applications", McGraw Hill, 2012. 3. Richard D. Klafter, Thomas A, Chri Elewski, Michael Negin, "Robotics Engineering an Integrated Approach", Phi Learning. 2009. 4. Saeed B Niku, "Introduction to Robotics Analysis, Control and Application" Wiley student 2nd Edition, **WEB RESOURCES:** 1. https://nptel.ac.in/courses/112/105/112105249/

Course topics (Theory)	**Week**	**Learning Outcome**
History Of Robot, INTRODUCTION, HISTORY OF ROBOTS, DEFINITION OF A ROBOT, INDUSTRIAL ROBOT.	1	
BASICS OF ROBOTICS, Basic Concepts – Definition – Need for robots – Three laws – Degrees of Freedom. Robot – Components of a robot.	2	
Classification of robots Articulated – Cartesian – Cylindrical – Polar – SCARA – Delta – Robot anatomy – Co-ordinate systems, Work envelope – Specifications –	3	

Pitch, yaw, roll, joint notations, speed of motion and pay load – Robot parts and their functions — Different industrial applications.		
ROBOT END EFFECTOR AND VISION SYSTEM, End effectors – Grippers: Mechanical grippers, Hydraulic & Pneumatic grippers, Magnetic grippers, Vacuum grippers, RCC grippers – Two and three fingered grippers – Internal and external grippers – Selection considerations, Gripper force analysis.	4	
Camera, frame grabber, sensing and digitizing image data – Signal conversion – Image Storage – Image processing and analysis – Data reduction – Segmentation – Feature extraction – Object recognition – Applications – Inspection, identification, visual serving and navigation.	5	
KINEMATICS AND DYNAMICS OF ROBOT, Manipulator kinematics – Forward kinematics – Inverse kinematics – Differences: Forward kinematics and Reverse kinematics of manipulators with two and three degrees of freedom (In 2 dimensional), four degrees of freedom (In 3 dimensional) – Deviations and problems. Robot dynamics.	6	
ROBOT CONTROL SYSTEMS AND PROGRAMMING Teach pendant programming – Lead through programming – Robot programming languages – Robot programming as a path in space, Motion interpolation – Robot Languages: Textual robot Languages, Generation.	7	
Types of transmission, Basics of control Systems – Open loop and Closed loop system – Types of Controllers, Process Control Systems, Discrete Control System, Continuous Versus Discrete Control. Linear and Non-linear controls.	8	
APPLICATIONS OF ROBOT, Robot Application – Implementation of robots in industries – Various steps, Machine loading/unloading.	9	
Processing operation, Assembly and Inspection, Feature Application. Types of locomotion.	10	
Hopping robots, Legged robots, Wheeled robots, Wall climbing robots, COBOTS.	11	
Sensors for mobile robots like global positioning system (GPS), Path planning algorithms, Stochastic dynamic programming (SDP).	12	
Practical Topics	**Week**	**Learning Outcome**

LABORATORY ACTIVITY 1 – FRAMES.	1	
LABORATORY ACTIVITY 2 – INTRODUCTION TO TP MOTION PROGRAMMING	2	
LABORATORY ACTIVITY 3 – TP MOTION PROGRAMMING.	3	
LABORATORY ACTIVITY 4 – INTRODUCTION TO TP PROGRAM CONTROL STRUCTURES.	4	
LABORATORY ACTIVITY 5 – PALLETIZING AND DEPALLETIZING.	5	
LABORATORY ACTIVITY 6/7 – OFF-LINE ROBOT PROGRAMMING.	6	
LABORATORY ACTIVITY 8 – I/O WIRING, ASSIGNMENT, AND WORK-CELL DESIGN.	7	
LABORATORY ACTIVITY 9 – EOAT/END EFFECTORS.	8	
LABORATORY ACTIVITY 10 – Research Robotics Video or Free Laboratory.	9	
Conclusions and Future Work.	10	
	11	
	12	