Kingdom of Saudi Arabia
Ministry of Higher Education
Qassim University
College of Engineering

المملكة العربية السعودية
وزارة التعليم العالي
جامعة القصيم
كليه الهندسه

Automation & Robotics

College: Engineering

Department: Electrical

First: Course Definition, a Summary:

1- Course Code: EE 615

2- Units: 3 credit hrs

3- Level: 3rd

4- Prerequisite: Basic knowledge of mechatronics, robotics, industrial automation is required

5- Co-requisite:

6- Location (if not on main Campus):

Second: Course Objectives

- Give students an appreciation of the Automation and Control which are pervasive enabling technologies, found in almost any modern technical system, in particular in Production and Transportation System.
- Robots are key components in modern factories and will increasingly be used in the service sector and for unmanned operations in hostile environments. Thus there is a growing need for engineers who can design, maintain and upgrade those complex automation systems.
- This course enhances the student's knowledge and skills in the areas of Programmable Logic Controllers (PLC), Sensor Technology, Industrial Robotics, and Design & Integration of an Automated System (e.g., flexible manufacturing cell).
- It also provides the necessary foundations for a professional career in the field of Automation, Control and Robotics in the information age.

Third: Course Description

1- Topics to be covered		
Subject	**No of Weeks**	**Units**
• Introduction to Robotics & Automation and Robotic Applications	1	3
• Industrial Robots Classification – Kinematic Structure, Work envelope, Control System & Actuation	2	6
• Robot Kinematic Design	2	6
• Electric Actuators & Control Techniques - DC Motors, Induction Motors	2	6
• Synchronous AC motors • Other actuators (Pneumatic, Hydraulic, Non traditional – SMA, Air muscle) • Robot Transmission Components - Conventional components (Gear drives, Belt drives & Chain drives), Ballscrew assemblies, Harmonic drives, Sensors	3	9
• Robot controllers & programming • Kinematic analysis of Planar & SCARA Robots Common Automation Systems	3	9
• Automated Systems & Programmable Logic Controllers (PLCs)	2	6

2- Course components (Total hrs in the Semester: 60

Lectures	Exercises	Other
45	----	----

3- Intended Learning Outcomes of the Course (ILO's)

a. *Knowledge*

i) Description of the knowledge to be acquired:

- Industrial Automated Applications
- Robotic Kinematic Design
- Control Techniques

ii) Teaching strategies to be used to develop that knowledge

- Class lectures

- Students' presentations
- Group discussion in the Class
- Assignments
- Case study Report (data collection, internet search, and reporting

iii) Methods of assessment of knowledge acquired

- Exams
- Quizzes
- Homework assignments
- Term projects

b- Cognitive (Intellectual) Skills

i) Cognitive skills to be developed

- The ability to analyze, and determine the automation applications
- Ability to design kinematics
- Ability to analyze PLCs

ii) Teaching strategies to be used to develop these cognitive skills

- Class lectures
- Case studies analysis
- Term projects

iii) Methods of assessment of students' cognitive skills

- Students' seminars and presentations
- Term projects
- Written reports

c. Interpersonal Skills and Responsibility

i) Description of the interpersonal skills and capacity to carry responsibility to be developed

- Decision making based on engineering analysis
- Communication skills
- Team work

ii) Teaching strategies to be used to develop these skills

- Reports
- Term team projects
- Presentations and seminars

iii) Methods of assessment of students' interpersonal skills and capacity to carry responsibility

- *Evaluation of the team* projects
- Written reports

- Students' seminars and presentations

d. Communication, Information Technology and Numerical Skills

i) Description of the skills to be developed in this domain
- Literature search
- Problems numerical modelling
- Utilization of computer applications in analysis and design

ii) Teaching strategies to be used to develop these skills
- Class lectures
- Case studies analysis
- Computer lab sessions
- Term projects

iii) Methods of assessment of students numerical and communication skills
- Term projects
- Written reports
- Students' seminars and presentations

e. Psychomotor (if applicable) & Other Non-cognitive Skills

i) Description of the psychomotor or other skills to be developed and the level of performance required
- NA

ii) Teaching strategies to be used to develop these skills-
- NA

iii) Methods of assessment of student's psychomotor skills
- NA

4- Student Assessment Schedule

Serial	*Assessment tool (test, group project, examination etc.)*	*Week due*	*Weight*
1	Term Project	3rd	30 %
2	Mid Term Exam -1	7th	20 %
5	Final Exam	16th	50 %

5- Student Support

- Providing electronic library for references and scientific periodicals. Students have access to the ieeeXplore and ScienceDirect digital libraries of the IEEE and Elsevier respectively
- Providing the necessary computer applications for the course.

6- Learning Resources

i) Essential Books (References)

- Mathematical Introduction to Robotic Manipulation by Richard M. Murray, Zexiang Li, S. Shankar Sastry
- Robot Manipulator Control: Theory and Practice (Control Engineering, 15) by Frank L. Lewis, et al
- Introduction to Robotics: Mechanics and Control (3rd Edition) by John J. Craig
- Programmable Logic Controllers, John W. Webb, R. A. Reis, 6th Ed., Prentice Hall, 2006
- Fundamentals of Programmable Logic Controllers, Sensors, and Communications, Jon Stenerson, 3nd Ed., Prentice Hall, 2005
- Sensors & Control Systems in Manufacturing, S. Soloman, McGraw-Hill, 1994

ii) Course Notes Course materials are uploaded on the College Web-Site (www.qec.edu.sa) to be available for the students.

iii) Recommended Books

Production Systems, & Computer-Integrated Manufacturing, Mikell P. Groover, 2nd Ed., Prentice Hall
Introduction to Robotics Analysis, Systems, Applications by Saeed B. Niku
Fundamentals of Robotics Analysis & Control Robert J. Schilling

iv) Electronic Books & Web Sites:

- Scientific journals and forums.

Students have access to the ieeeXplore and ScienceDirect digital libraries of the IEEE and ElSevier respectively

v) Periodicals

-IEEE and Elservier Journals

7- Course Evaluation and Improvement Processes

i) Strategies for Obtaining Student Feedback on Effectiveness of Teaching

- Students' Questionnaires
- Observing the students opinions recorded in the college student site
- Appeal box
- Carrying out extensive questioners by a sample of the distinguished students just after the graduation from the college

ii) Other Strategies for Evaluation of Teaching by the Instructor or by the Department

- Instructor report
- Public faculty seminars
- Periodical review of the teaching methods by both the department council and the education affairs vice dean

iii) Processes for Improvement of Teaching

- Assessment of students' work by external examiners
- Analysis of students' evaluation of course and instructor
- Seminars by industry professionals
- Evaluation of the course outlines and student works by external staff member
- Periodical contact with different engineering authorities and industries for evaluating and getting their feedback and suggestions concerning the course outlines

iv) Processes for verifying standards of student achievement

- Check marking by an independent faculty member of a sample of student work
- Periodic exchange and remarking of a sample of assignments/exams with a external evaluator

v) Describe the planning arrangements for periodically reviewing course effectiveness and planning for improvement.

- Assessment and evaluation of the level of achieving the course outcomes through a continuous improvement process (part of a quality assurance system established by the university)
- Consequently, actions are to be taken to improve the course delivery when necessary
- Review of the course objectives, outcomes and curriculum every 2 years