MNE3046: AUTOMATION TECHNOLOGY

Effective Term
Semester A 2023/24

Part I Course Overview

Course Title
Automation Technology

Subject Code
MNE - Mechanical Engineering
Course Number
3046

Academic Unit
Mechanical Engineering (MNE)

College/School
College of Engineering (EG)

Course Duration
One Semester

Credit Units
3

Level
B1, B2, B3, B4 - Bachelor's Degree

Medium of Instruction
English

Medium of Assessment
English

Prerequisites
ADSE2011 Fundamental Engineering Analysis and Design for Manufacturing Engineers II or
EE2005 Electronic Devices and Circuits or
MBE2029/BME2029/MNE2029 Electrical and Electronic Principles I or equivalent

Precursors
Nil

Equivalent Courses
MBE3046 Automation Technology

Exclusive Courses
Nil

Part II Course Details

Abstract

The aim of this course is to introduce concepts of fixed, programmable and flexible automation/mechatronics, their design, implementation, application and cost-effects. The emphasis will be placed on

- the utilization of mechanization devices and material handling systems;
- the "design-for-assembly" principles;
- the most common part and motion sensing devices (excluding machine vision);
- programmable motion controllers, with an emphasis on how to build two-state on/off, combinational, and sequential automation systems – by relying on case studies, appreciate the maturity, versatility and effectiveness, as well as limitations, of the technology involved;
- the construction, performance, programming and application of non-servo (limited sequence) robots and expected cost effects;
- the development, anticipation, selection and supervision of the implementation of flexible assembly systems in manufacturing;
- the design and development of a mini-project to demonstrate automatic control capability through the techniques and tools learned in the course.

Course Intended Learning Outcomes (CILOs)

	CILOs	Weighting (if app.)	DEC-A1	DEC-A2	DEC-A3
1	Identify technology options for automating a production facility or process after simplifying the operations (by design-for-assembly and similar considerations).		x		
2	Generate for this task solutions that may form the fixed, programmable or flexible automation systems and then hypothesise cost-effects of implementing it in order to assess possible alternatives.			x	
3	Analyse possible partitioning of the adopted automation- concept into functional modules, then into individual devices, while either identifying standard engineering components that are commercially available for such devices or compiling the performance specification for non-standard engineering components that must be custom built.			x	
4	Integrate part and motion sensing devices, with material handling, testing, robotic or other subsystems, into a microprocessor-controlled system with programmable controllers and simple electronic-signal interfacing requiring aspects of digital electronics.		x	x	x

A1: Attitude
Develop an attitude of discovery/innovation/creativity, as demonstrated by students possessing a strong sense of curiosity, asking questions actively, challenging assumptions or engaging in inquiry together with teachers.

A2: Ability
Develop the ability/skill needed to discover/innovate/create, as demonstrated by students possessing critical thinking skills to assess ideas, acquiring research skills, synthesizing knowledge across disciplines or applying academic knowledge to real-life problems.

A3: Accomplishments
Demonstrate accomplishment of discovery/innovation/creativity through producing /constructing creative works/new artefacts, effective solutions to real-life problems or new processes.

Teaching and Learning Activities (TLAs)

	TLAs	Brief Description	CILO No.	Hours/week (if applicable)
1	Lecture	Traditional lecture with case studies.	1, 2, 3, 4	3 hrs/week
2	Laboratory Work	Hands-on experience.	1, 2, 3, 4	3 hrs/week for 3 weeks

Assessment Tasks / Activities (ATs)

	ATs	CILO No.	Weighting (%)	Remarks (e.g. Parameter for GenAI use)
1	Laboratory Reports	2, 3, 4	30	3 reports to be submitted
2	Mini-project (group) with presentations	1, 2, 3, 4	30	1 Report to be submitted with presentations. The presentation will be marked independently by a panel composed by 2-3 members (Teaching staff and assistants). A peer assessment form will also be collected from each member of a group.

Continuous Assessment (%)

60

Examination (%)

40

Examination Duration (Hours)

2.5

Additional Information for ATs

For a student to pass the course, at least 30% of the maximum mark for both coursework and examination should be obtained

Assessment Rubrics (AR)

Assessment Task

1. Laboratory Reports

Criterion

Application of control principles. Explain differences between theory and practice.

Excellent (A+, A, A-)

Strong evidence of original thinking; excellent capacity to analyse and synthesize experimental data and systems; superior grasp of hand-on skills; clear evidence of extensive knowledge base in data interpretation, system integration, analysis skills, and/or technical trends.

Good (B+, B, B-)

Evidence of grasp of subject topics, and some evidence of critical capacity and analytic ability in control systems; reasonable understanding of basic control theory and methods; evidence of familiarity with the literature of control engineering.

Fair (C+, C, C-)

Student who is profiting from the university experience; understanding of the main control topics; ability to develop solutions to simple problems in control system integration.

Marginal (D)

Sufficient familiarity with the subject matter in control system integration to enable the student to progress without repeating the course.

Failure (F)

Little evidence of familiarity with the control essential methods; weakness in critical and analytic skills in using control methods; limited or irrelevant use of taught control theory or methods in experiments.

Assessment Task

2. Mini-project (group) with presentations

Criterion

Application of control principles. Explain differences between theory and practice.

Excellent (A+, A, A-)

Strong evidence of original thinking; excellent capacity to analyse and synthesize experimental data and systems; superior grasp of hand-on skills; clear evidence of extensive knowledge base in data interpretation, system integration, analysis skills, and/or technical trends.

Good (B+, B, B-)

Evidence of grasp of subject topics, and some evidence of critical capacity and analytic ability in control systems; reasonable understanding of basic control theory and methods; evidence of familiarity with the literature of control engineering.

Fair (C+, C, C-)

Student who is profiting from the university experience; understanding of the main control topics; ability to develop solutions to simple problems in control system integration.

Marginal (D)

Sufficient familiarity with the subject matter in control system integration to enable the student to progress without repeating the course.

Failure (F)

Little evidence of familiarity with the control essential methods; weakness in critical and analytic skills in using control methods; limited or irrelevant use of taught control theory or methods in experiments.

Assessment Task

3. Examination

Criterion

Describe the fundamental concepts of engineering mechanics and apply them to solve the problems that involve loading and motion.

Excellent (A+, A, A-)

Strong evidence of original thinking; good organization, capacity to analyse and synthesize; superior grasp of subject matter; evidence of extensive knowledge base.

Good (B+, B, B-)

Significant evidence of grasp of subject, some evidence of critical capacity and analytic ability; reasonable understanding of issues; evidence of familiarity with course matter.

Fair (C+, C, C-)

Student is profiting from the university experience; understanding of the mechanics; ability to develop solutions to simple problems in the course.

Marginal (D)

Basic familiarity with the subject matter to enable the student to progress without repeating the course.

Failure (F)

Little evidence of familiarity with the subject matter; weakness in critical and analytic skills; very limited demonstration of correct use knowledge in mechanics.

Additional Information for AR

Note: For a student to pass the course, at least 30% of the maximum mark for both coursework and examination should be obtained

Part III Other Information

Keyword Syllabus

Overview of Automation. Design for Assembly and/or mechatronics. Part and motion sensing devices (excluding machine vision). System integration, material handling, testing, and/or other subsystems. Automated cells. Programmable controller design, analysis and ladder diagram. Basic electronic interface circuits for device integration. Boolean logic, logic gates and simple designs. Design and control of non-servo robots from standard components.

Reading List

Compulsory Readings

	Title
1	Frank Lamb, Industrial Automation: Hands-On, McGraw-Hill, 2013.
2	Siciliano, Bruno, and Oussama Khatib, eds., Springer Handbook of Robotics, Springer Science & Business Media, 2008.

Additional Readings

	Title
1	S. B. Morriss, Automated Manufacturing Systems, McGraw-Hill Int. Editions.
2	Bishop, Christopher M., Pattern Recognition and Machine Learning, Springer, 2006.
3	N. P. Mahalik, Mechatronics, McGraw-Hill.