Level 5 Pearson Higher National Diploma in Electrical and Electronics Engineering

Assignment Brief

Unit Number and Title	**45: Industrial Systems**
Academic Year	
Unit Tutor	
Assignment Title	Analysis of Industrial Systems
Issue Date	
Submission Date	
IV Name & Date	
Unit Learning Outcomes	

LO1: Describe the main elements of an electronically controlled industrial system.

LO2: Identify and specify the interface requirements between electronic, electrical and mechanical transducers and controllers.

LO3: Apply practical and computer-based methods to design and test a measurement system.

LO4: Apply appropriate analytical techniques to predict the performance of a given system.

Assignment Brief and Guidance

Scenario:

Industrial control system is a collective term used to describe different types of control systems and associated instrumentation, which includes devices, systems, network and controls used to operate and/or automate industrial processes. Depending on the industry, each ICS functions differently and are built to electronically manage tasks efficiently. This could include process control, data processing, data transfer, system analysis, and so on.

You are working as an electrical engineer in industry and you have been tasked to look after control processes and to make sure that existing processes and corresponding items/devices function orderly and in a smooth fashion. A report must be prepared in order to analyse and explain how the control system works. From your practical experiences, you must analyse the results carefully using methodologies that you have learnt in Industrial systems. This is enhanced by the fact that you have studied this both theoretically and practically during your studies. Your report must be clear and laid out in a professional way as this will have a major impact on how the results are accepted from practical experiences in the job that you are doing. All the tasks must be finalised on time and the analysis must be thorough and convincing.

LO1: Describe the main elements of an electronically controlled industrial system

Task 1

a. Describe the main elements involved in an electronically controlled industrial system. This should ideally include an example to aid the description. You should also discuss and justify why these elements need to be included.

b. Review the main concepts of electronically controlled industrial systems including types of motors and discrete controls system as well as input and output devices used in industrial systems. Your answer must show the diagrams that fully explain your reviews.

c. Examine the performance of an electronically controlled system of your choice. Give justified recommendations that could be made to improve the product.

LO2: Identify and specify the interface requirements between electronic, electrical and mechanical transducers and controllers

Task2

a. Identify what type of circuit to be used when using a sensor to measure different physical quantities and also explain the importance of a controller in a industrial control system.

b. Give justifications for the choice of transducers and controllers in a robotic linear motion. Your answer must show the control method used and also the types of transducers used in this linear motion and the reasons behind this choice.

c. Predict the behavior of pneumatic, hydraulic and electrical actuators by applying different controlling methods. You must give your reasons for choosing any controlling method for a particular application and ways to improve performance of these methods.

d. Critically investigate the behavior of different control system for passive and active actuators and transducers as well as sensors for temperature and pressure control and give a full comparison between the different methods including the limitations of these approaches.

LO3: Apply practical and computer-based methods to design and test a measurement system

Task 3

a. Explain how a temperature sensor used in temperature measurement and control system can be calibrated both practically and virtually.

b. Interpret the features and behavior of a chosen electronic measurement systems which you encountered in your practical or simulation experiments. Use in your answer different methods to find a solution to the accuracy and errors of these devices.

c. Using simulation, critically evaluate the performance of a measurement system which you have used in the experiment that you have carried out during your studies and compare both the ideal and real circuit. Include in your answer explanations of the errors and accuracy of this system.

LO4: Apply appropriate analytical techniques to predict the performance of a given system.

Task 4

a. Use computer software of your choice including Matlab, Simulink, PSPICE and others to analyse the analytical techniques used in the chosen software in controlling, motors, transducers and actuators. Your answers should explain the performance of these systems and how these techniques compared to practical measurements.

b. Evaluate the features and characteristics of industrial control of induction motors. Your evaluation should include analytical techniques used for controlling induction motor and the limitations and advantages of these techniques.

c. Analyse the control of large stepper motors in industrial systems. Your answer should include the appropriate analytical techniques used in this system giving justification and recommendations in order to improve the performance of such systems.

Guidelines for assignment submission

a. Assignment has **4 tasks. Please read all tasks carefully.**
b. Final assignment must be submitted on time to be considered for a Distinction grade
c. **PLAGIARISM** is considered a serious offence and will automatically lead to a **FAIL Grade**. In the event of similar/identical submissions, please note **that both students will be automatically fail the module.**

The grades are awarded holistically according to the table included at the end of this assignment.

d. To achieve a **Pass grade** the learner must complete all the **pass criteria (P1-P7).**
e. To achieve a **Merit grade** the learner must complete all the **pass criteria + M1,M2,M3 & M4.**
f. To achieve a **Distinction grade** the learner must complete **all the pass and merit criteria + D1, D2, D2 and D4.**

Learning Outcomes and Assessment Criteria

<table>
<tr><th>Pass</th><th>Merit</th><th>Distinction</th></tr>
<tr><td colspan="2">LO1 Describe the main elements of an electronically controlled industrial system</td><td rowspan="3">D1 Critically examine the performance of an electronically controlled system to make recommendations for improvement</td></tr>
<tr><td>P1 Describe the main elements of an electronically controlled industrial system

P2 Review the main concepts underlying electronically controlled industrial systems</td><td>M1 Analyse the characteristics of an electronically controlled industrial system by applying a variety of techniques to the solution of a given problem</td></tr>
<tr><td colspan="2">LO2 Identify and specify the interface requirements between electronic, electrical and mechanical transducers and controllers</td></tr>
<tr><td>P3 Identify the interface requirements between electronic, electrical and mechanical transducers and controllers

P4 Justify the choice of transducers and controllers for a given task</td><td>M2 Predict the behaviour of an electronically controlled industrial system by applying a variety of transducers to the solution of a given problem and choose a ‘best’ solution</td><td rowspan="3">D2 Critically investigate the behaviour of a given control system to compare different electrical, electronic, and mechanical approaches to control</td></tr>
<tr><td colspan="2">LO3 Apply practical and computer-based methods to design and test a measurement system</td></tr>
<tr><td>P5 Apply practical and computer-based methods to design and test a measurement system

P6 Explain the use of practical and analytical methods in creating and testing a measurement system</td><td>M3 Interpret the characteristics and behaviour of an existing electronic measurement system by applying a variety of methods to find a solution to a given problem</td><td>D3 Critically evaluate the performance of an ideal measurement system compared to a real circuit</td></tr>
</table>

Pass	Merit	Distinction
LO4 Apply appropriate analytical techniques to predict the performance of a given system		**D4** Analyse an existing industrial system by using appropriate analytical techniques Provide justified recommendations to improve the performance
P7 Apply the main analytical techniques to explain the performance of a given system	**M4** Evaluate the characteristics of an electronically controlled industrial system by applying a variety of analytical techniques to the solution of a given problem	

Glossary of Command Verbs

Term	Definitions
Describe	Give an account, including all the relevant characteristics, qualities and events.
Review	Make a formal assessment of work produced. The assessment allows students to: ● appraise existing information or prior events ● reconsider information with the intention of making changes, if necessary..
Analyse	Present the outcome of methodical and detailed examination either: ● breaking down a theme, topic or situation in order to interpret and study the interrelationships between the parts; and/or ● of information or data to interpret and study key trends and interrelationships. Analysis can be through activity, practice, written or verbal presentation.
Identify	Indicate the main features or purpose of something by recognising it and/or being able to discern and understand facts or qualities.
Critically evaluate	Make a judgement taking into account different factors and using available knowledge/experience/evidence where the judgement is supported in depth.
Demonstrate	Show knowledge and understanding.
Evaluate	**Work draws on varied information, themes or concepts to consider aspects, such as:** **● strengths or weaknesses** **● advantages or disadvantages** **● alternative actions** **● relevance or significance** **Students' inquiries should lead to a supported judgement showing relationship to its context. This will often be in a conclusion. Evidence will often be written but could be through presentation or activity**
Justify	**Students give reasons or evidence to:** **● support an opinion; or**

	• **show something to be right or reasonable.**
Apply	Put into operation or use. Use relevant skills/knowledge/understanding appropriate to context.
Interpret	State the meaning, purpose or qualities of something through the use of images, words or other expression.
Explain	To give an account of the purposes or reasons