PHASE 2 INSTRUMENTS POWER and CONTROL PROJECT LIST

PHASE 2 INSTRUMENTS
P/C Instrument Stream (update 2014/15)
PROJECT LIST

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Ball Valve
Diaphragm Valve
Butterfly Valve

V4. STROKE CHECKING
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M1. RIG

CAROUSEL 1

Instrument Equipment and Systems

PHASE 2 INSTRUMENTS

PROJECT TITLE	MEASUREMENT of PROCESS VARIABLES
R.O.A.SUBJECT AREA	I-12 WORKSHOP SAFETY (Procedures and Practice)

The learner is able to demonstrate knowledge and understanding of :

- maintaining safety of self by ensuring :
  a) overalls are a suitable fit and are securely fastened to chest level
  b) overalls sleeves are rolled down and cuffs are in good condition
  c) overalls are clean / relatively free from contamination, e.g. grease
  d) boots are the correct fit and laces are appropriately tied
  e) jewellery is either removed or suitably covered before work commences
  f) any loose items are removed and, when applicable, any long hair is suitably protected
  g) gloves and eye protection are worn and are suitable for the task
- the importance of housekeeping before, during and after the task is completed
- awareness of the workshop environment and associated hazards including:
  a) the presence of dangerous air pressures
  b) protruding edges
  c) heavy and/or unbalanced loads
  d) the presence of moving parts that have the potential to harm,
  e) the presence of electrically controlled equipment
  f) potentially hot equipment
  g) contaminated PPE, equipment and tools
  h) hazardous substances, e.g. resins, adhesives, lubricants, etc)
- visual inspection of all tools and equipment prior to, and following, their use
- selecting the correct tool for the task
- the correct values and behaviours including :
  a) paying attention to the task and any instructions being given
  b) keeping the work area and tools and equipment clean
  c) recognising potential hazards and act upon them
  d) maintaining personal hygiene
  e) recognising the impact of tiredness and/or stress
- awareness of the impact of their behaviour on others

PHASE 2 INSTRUMENTS

PROJECT No	**F1**
PROJECT TITLE	**MEASUREMENT of PROCESS VARIABLES**
R.O.A.SUBJECT AREA	**I-13 FOUNDATION**

Aim(s)

To investigate (recap) various technologies used to measure a range of Process Variables.

This project acts to recap on material covered in phase 1.

Task

In this task you will investigate, and demonstrate understanding of a range of measuring techniques used to measure the primary process variables:

You need to ensure you have a complete set of course notes from Phase 1

You will be presented with a question and answer document(s), which cover theoretical and practical elements.

The pass mark for this is 100%. You have **not** finished until you can answer **ALL** questions successfully.

Task Analysis

Attach a copy of your completed Question and Answer Document(s)

PHASE 2 INSTRUMENTS

PROJECT No	**F2**
PROJECT TITLE	**INSTRUMENT LINE DIAGRAMS**
R.O.A.SUBJECT AREA	**I-13 FOUNDATION**

Aim(s)

To gain an understanding of Instrument Line Diagrams, and produce a series of usable Instrument Line Diagrams for future use

Prior to completing this assignment, you will need to have completed the input on Instrument Line Diagrams.

Health and Safety

- Read through the project and produce a written risk assessment countersigned by your Training Officer

Task

- On the training Plant there are a variety of process measurement and control devices;
- Select a device, making note of any reference numbers, then using a Digital Multi-Meter (DMM) carefully trace the signal connections of your chosen device taking note of termination numbers, cable numbers, junction boxes and any other components in the loop and their termination numbers.
- With this information produce an Instrument wiring loop diagram to the agreed format.
- With the whole group, produce a series of line diagrams for all instrument loops on the outside training rig. Compile a line diagrams pack, that will be issued to all team members for use further in the program.
- Investigate the numbering and lettering systems used in instrument loop identification systems.

Task Analysis

- Produce a brief written report on how you completed the practical, and include the line diagram pack you have produced.

PHASE 2 INSTRUMENTS

PROJECT No	**F3**
PROJECT TITLE	**INSTRUMENT EQUIPMENT and SYSTEM INSTALLATION METHODS**
R.O.A.SUBJECT AREA	**I-13 FOUNDATION**

Aim(s)

To gain an understanding of the methods used to install instrument equipment and systems

Health and Safety

- Read through the project and produce a written risk assessment countersigned by your Training Officer

Task

On the training Plant there are a variety of process measurement and control devices;

- Investigate a range of installation requirements for a range of instruments and systems. You need to include:
    - Various methods of how process media is taken from plant to instrument.
    - Different types of cables and glanding used
    - Different methods used for transporting instrument air signals/supplies
    - Types of Junction boxes, and what is meant by ‘IP rating’.
    - Use of instrument ‘stands’.
    - Why is it important to make cable and pipe runs as neat as possible rather than as short as possible
    - Why leave a loop of cable before connection into an instrument
- For this part of the task you will be required to perform practical tasks. You will be required to:
    - Replace an instrument signal cable
    - Fabricate and fit cable tray
    - Replace a / section of instrument air line

Task Analysis

- Produce a brief written report

PHASE 2 INSTRUMENTS

PROJECT No	**F4**
PROJECT TITLE	**CALIBRATION AND COMMISSIONING**
R.O.A.SUBJECT AREA	**I-13 FOUNDATION**

Aim(s)

To gain an understanding of Calibration and Commissioning techniques, used to determine the functionality of process measurement / control loops

Prior to completing this assignment, you will need to have completed Instrument Line Diagrams from task F2.

Health and Safety

- Read through the project and produce a written risk assessment countersigned by your Training Officer. *You may need process authorisation to complete this task.*

Task

You will be assigned control/ measurement loop(s) and equipment to work on, and you will be given instructions on what is required for each task. By the end of this task you need to be able to demonstrate how you can complete the following tasks:

- Obtain appropriate authorisation and Permit to Work, giving correct information on the task, and how this may impact on the process.
- Obtain the calibration data (range)
- Using appropriate test equipment, perform calibration checks on a range of instrument systems and equipment, ensuring its calibration range matches that on the data sheet, and that any associated equipment indicate or operate correctly.
- Perform bench calibrations
- Perform on site (in situ) calibrations
- Perform calibrations on items removed from plant.
- Complete a calibration report sheet for each component

Task Analysis

- Produce a brief written report on the practical, and include a copy of the calibration report(s) and Permit(s).

PHASE 2 INSTRUMENTS

PROJECT No	**F5**
PROJECT TITLE	**FAULT FINDING on Instrument Control Loops**
R.O.A.SUBJECT AREA	**I-13 FOUNDATION**

Aim(s)

To gain an understanding of Fault Finding techniques, used to determine the functionality of a process measurement / control loop

Line diagrams from F2 may be useful for this task

Health and Safety

- Read through the project and produce a written risk assessment countersigned by your Training Officer. *You may need process authorisation to complete this task.*

Task

- Identify where information may be obtained to help you solve system faults you may encounter in working with Instrument systems

- Research methods of fault finding, and explain (with example) how these will help you in the future. Include the following techniques in your research:-

    1. Half Splitting
    2. Function Block (Flow) Diagrams – (Yes/No)

You MUST have completed the first part of the task before moving on.

- You will be assigned control/ measurement loop(s) to work on, and you will be given instructions on what is required for this task.

- Obtain appropriate authorisation and Permit to Work.

- Using appropriate methods, identify and where possible rectify any fault(s) on the instrument system

- Complete a calibration report sheet for each component

Task Analysis

- Produce a brief written report on the practical, and include a copy of the calibration report.

- Break down/ identify the method(s) you used to solve this system fault

CAROUSEL 2

Hazard Area Equipment and Process Control

PHASE 2 INSTRUMENTS

PROJECT No	**H1a**
PROJECT TITLE	**PROTECTION IDENTIFICATION**
R.O.A.SUBJECT AREA	**I-15 HAZARDOUS AREA EQUIPMENT**

Aim(s)

To introduce a foundation level of understanding of 'Hazardous Area Equipment', as used in Instrumentation.

Task

In this task you will investigate, recognise and demonstrate understanding of:

1. The need for Hazardous area equipment.

2. Legislation, and legal obligations. (HSE, DSEAR, ATEX, EPS)

3. The definition of a Hazardous Area, including what is meant by the terms:

    - Flashpoint
    - Auto – Ignition
    - Flammable Mixture
    - Lower Explosive Limit
    - Upper Explosive Limit

4. The classifications (zones) of Hazardous areas

5. Types of protection required for different hazardous conditions.

6. Gas groups and Temperature Classification

7. How Hazardous Area Equipment is identified and briefly explain the marking system, and to recognise equipment

8. The theories/ and difference(s) between Flameproof (Ex.d) and Intrinsically Safe (Ex ia/Ex ib).

9. Measures that can be taken to protect 'mains operated' equipment, (Ex p)

10. Working on equipment in hazardous areas. (Calibration, replacing equipment)

11. System Certificates.

Task Analysis

- Complete the written 'Hazardous Area Equipment' questionnaire.

PHASE 2 INSTRUMENTS

PROJECT No	**H2a**
PROJECT TITLE	**FAULTFINDING on Hazardous Area Equipment**
R.O.A.SUBJECT AREA	**I-15 HAZARDOUS AREA EQUIPMENT**

Aim(s)

To investigate and identify 'Hazardous Area Equipment', as used in Instrumentation.

Health and Safety

- Read through the project and produce a written risk assessment countersigned by your Training Officer.

Task

In a given workshop / or work area:

1. Identify items of equipment which are I.S (Ex ia)
2. Identify items of equipment which are Ex.d (Flameproof)
3. Look for faults on given systems, and Identify any faults you may find which compromise the protection.
4. Explain how the faults found can compromise protection
5. Identify the different types and styles of cable glanding used in I.S and Non I.S systems.

Task Analysis

- Produce a brief written report on the practical, and provide evidence of the above

PHASE 2 INSTRUMENTS

PROJECT No	**C1**
PROJECT TITLE	**PROCESS CONTROL THEORY and MODES OF CONTROL**
R.O.A.SUBJECT AREA	**I-17/ 18 MODES OF CONTROL**

Aim(s)

To gain understanding and knowledge of Process Control theory and the effects of the 3 main Modes of Control.

In this task, you will study the theory of Process Control, before using this knowledge to connect up, configure and tune a process controller and control system.

Task

In this task you will investigate, research, and be able to explain:

1. What is meant by Manual Control, and give examples of when 'manual' is used. What caution must be observed when in Manual.

2. What is meant by Automatic Control, and give example(s) of when 'Auto' is used.

3. What is meant by 'Feedback' and 'Feedforward' Control, and give example of how each affects control of the process and where each may be used.

4. With mathematical examples/formula(s), how the control modes 'Proportional', Integral' and 'Derivative' take effect.

5. The terms, and relationship between 'Gain' and 'Proportional Band'

6. The effects of a process controller by 'transfer function/ block diagram.

7. How more than 1 process variable may be used to control a process using 'Cascade' control.

8. Where and how 'Ratio' control may be used effectively in controlling process operation. Explain where you would use this method of controlling a process.

Task Analysis

- Produce a brief written report which covers each of the above

PHASE 2 INSTRUMENTS

PROJECT No	**C2**
PROJECT TITLE	**CONFIGURE A CONTROLLER (Moore)**
R.O.A.SUBJECT AREA	**I-17 PROCESS CONTROL**

Aim(s)

To gain understanding of how to configure or change parameters of a Process Controller.

In this task, you will access and modify process controller settings.

This Project is based around the Moore Mycro 352 Process Controller

Health and Safety

- Read through the project and produce a written risk assessment countersigned by your Training Officer.

Task

1. Familiarise yourself with the layout of an electronic controller, i.e. faceplate, terminations, controls and nameplate.

2. Connect up the power supply to the controller and switch on.

3. Using information from manufacturers user manual configure a Moore Mycro 352 electronic controller as a “single loop PID controller with Hi and Lo alarms and with tracking setpoint.

4. Using the configuration manual, find out how to:

    - Move the position of the decimal point on the display, to show 2 decimal places.
    - Determine how to change the controller from direct to reverse mode.
    - Ensure the output bar graph matches that of the control valve action
    - Change the controller from ‘PID’ to ‘PD’ to ‘P’ only

Task Analysis

- Produce a written report for the above, include a copy of the configuration manual.

PHASE 2 INSTRUMENTS

PROJECT No	**C3**
PROJECT TITLE	**CONFIGURE A CONTROLLER (TCS)**
R.O.A.SUBJECT AREA	**I-17 PROCESS CONTROL**

Aim(s)

To gain understanding of how to configure or change parameters of a Process Controller.

In this task, you will access and modify process controller settings.

This Project is based around the TCS '6 series' Process Controller

Health and Safety

- Read through the project and produce a written risk assessment countersigned by your Training Officer.

Task

1. Familiarise yourself with the layout of an electronic controller, i.e. faceplate, terminations, controls and nameplate.

2. Connect up the power supply to the controller and switch on.

3. Using information from manufacturers user manual configure a Moore Mycro 352 electronic controller as a "single loop PID controller with Hi and Lo alarms and with tracking setpoint.

4. Using the configuration manual, find out how to:

    - Move the position of the decimal point on the display, to show 2 decimal places.
    - Determine how to change the controller from direct to reverse mode.
    - Ensure the output bar graph matches that of the control valve action
    - Change the controller from 'PID' to 'PD' to 'P' only

5. Describe the difference between the two controllers.

Task Analysis

Produce a written report for the above, include a copy of the configuration manual

PHASE 2 INSTRUMENTS

PROJECT No	**C4**
PROJECT TITLE	**TUNING A PROCESS CONTROLLER**
R.O.A.SUBJECT AREA	**I-17 PROCESS CONTROL**

Aim(s)

To gain understanding of how modes of control affect the behaviour of a Process Controller and the effects on the control system.

For this task, you will require a Moore 352 Process Controller.

Health and Safety

- Read through the project and produce a written risk assessment countersigned by your Training Officer.

Task

1. On the back of the Moore controller, connect terminal 4 to terminal 7 and connect terminal 5 to terminal 8, this connects the output to the input and will simulate a process. (*Note: Connecting the controller up in this way is for training/simulation purposes only*.)

2. Bring the process under control by:

    a. Setting Integral Action to maximum
    b. Setting Derivative Action to minimum
    c. Note the Proportional setting and then halve it
    d. With the controller in “Auto” make a step change by moving the setpoint by about 10% in one swift movement
    e. Does the process come under control quickly? i.e. does the process move to a new position (not necessarily the setpoint) and steady out at this new position?
    f. If not then repeat steps c and d until it does
    g. Once achieved set the Integral Action to 1 and make a step change.
    h. Does the process rapidly settle out at the setpoint?
    i. If not halve the Integral Action setting and until it does.
    j. This process is now under control and does not need Derivative Action.

3. Set Derivative Action to 10, what happens to the process?

4. Mess up the settings, then Switch off the controller and remove the connections made in step 1

Task Analysis

- Produce a written report for the above.

PHASE 2 INSTRUMENTS

PROJECT No	**C5**
PROJECT TITLE	**CONSTRUCTING A CONTROL LOOP**
R.O.A.SUBJECT AREA	**I-17 PROCESS CONTROL**

Aim(s)

To gain understanding of where Process Controllers fit into a control loop.

In this task, you will connect up a process controller into a control system.

Health and Safety

- Read through the project and produce a written risk assessment countersigned by your Training Officer.

Task

1. You will be given a loop drawing (wiring diagram) from which you are required to wire up the associated control loop

2. Connect up the output side of the control loop, put the controller on manual and stroke check the output.

3. Connect up the input side of the control loop and check that the (PV) indication on the process controller gives a value between 0 and 100%. (*Readings of -3.33 and above 102 indicate a wiring or connection fault*)

4. With the controller on Manual, set the controller indication to PV and Zero the transmitter to the controller.

5. Connect appropriate test equipment (loop calibrator/ milliamp source) to replace the transmitter

6. Put the controller on to Auto, and put the Set point to 50%

7. Adjust the test equipment output between 4 - 20mA noting how the control valve responds to the change in process value.

8. Using the configuration settings, ensure the controller has the right direct/reverse control action. If not, correct it.

9. Return the controller to Manual, and reconnect the transmitter.

Task Analysis

- Produce a written report for the above, including the wiring diagram

PHASE 2 INSTRUMENTS

PROJECT No	**C6**
PROJECT TITLE	**TUNING A PROCESS CONTROL SYSTEM**
R.O.A.SUBJECT AREA	**I-17 PROCESS CONTROL**

Aim(s)

To gain understanding of how changing control modes, affects the behaviour of a Process control system

Health and Safety

- Read through the project and produce a written risk assessment countersigned by your Training Officer.

Task

1. Start the process on manual and open the valve output to 50%. Then, Switch the controller to Auto, and set the setpoint to 50%

2. Make the following adjustments

    a. Set the Proportional Gain setting (SPG1) to 100
    b. Setting Integral Action to 0 (STI1) to 0.01
    c. Setting Derivative Action to 0 (SDI1) to 0.00

    Note the behaviour of the system

3. Adjust the Proportional Gain to 50%, and change the setpoint slightly and note the behaviour, and continue to reduce the Gain by halves, until the system begins to settle, and steady oscillation occurs.

4. Introduce Integral action via STI1, and set to 1, and then decrease this in halves. Noting the effect this has on the oscillation process value.

5. Continue making small adjustments of Gain and Integral until the process variable matches the setpoint. You should now be able to adjust the setpoint and the process will track it.

6. Now adjust the Derivative via STD1 to 1.00, and what effect do you note.

7. Reduce the derivative by halves, adjust the setpoint, and note the effects and keep doing this until the process behaviour settles

8. Make a note of the 3 values you have obtained.

Task Analysis

- Produce a written report for the above, and include manufacturer data

PHASE 2 INSTRUMENTS

PROJECT No	**C7**
PROJECT TITLE	**TUNING A (multi variable) PROCESS CONTROL SYSTEM**
R.O.A.SUBJECT AREA	**I-17 PROCESS CONTROL**

Aim(s)

To gain understanding of 'Cascade Control' and how changing control modes affects the behaviour(s) of a Process control system.

You will require access to the Rig in workshop 9 for this task.

Health and Safety

- Read through the project and produce a written risk assessment countersigned by your Training Officer.

Task

Utilising the skills you have gained from Project C5, you are now going to use these to tune and control multiple process variables on a running plant. Please note that this control system has a cascade control loop, and you need to work out which is the primary and secondary controller.

1. Place all controllers to manual, and fully open each control valve.
2. Start the plant, and allow the systems to stabilise.
3. Using the single loop controllers first, one controller at a time, switch the controller to Auto and tune it.
4. Using the same principle, now tune the cascade loop. Note the primary controller should be set as FCO1 and the secondary should FCO4
5. Ensure that All controllers can be left in Auto, with the plant running, and that changing the setpoint, will cause the controller to attempt to bring the process variable to the setpoint.
6. Make a note of the 4 sets of values you have obtained, then mess up the controller(s).

Task Analysis

- Produce a written report for the above, and include manufacturer data

PHASE 2 INSTRUMENTS

PROJECT No	**C8**
PROJECT TITLE	**ADVANCED PROCESS CONTROL THEORY and TUNING METHODS**
R.O.A.SUBJECT AREA	**I-17 PROCESS CONTROL**

Aim(s)

To gain further understanding and knowledge of Process Control theory and the effects of the 3 main Modes of Control.

In this task, you will study more advanced theory of Process Control, in particular tuning methods and Function

You will require access to the Rig in workshop 9 for this task.

Health and Safety

- Read through the project and produce a written risk assessment countersigned by your Training Officer.

Task

1. With mathematical examples/formula(s), explain how the control modes 'Proportional', Integral' and 'Derivative' take effect.

2. Explain the effects of a process controller by 'transfer function/ block diagram.

3. Explain the 'Zeigler Nichols' methods of loop tuning.

4. Research other methods that have been used to tune process control loops

5. Investigate the AUTO TUNE function of a controller/ control system

Task Analysis

- Produce a written report for the above

PHASE 2 INSTRUMENTS

PROJECT No	**C9**
PROJECT TITLE	**USING DCS TO TUNE A PROCESS CONTROL SYSTEM**
R.O.A.SUBJECT AREA	**I-19 DISTRIBUTIVE CONTROL SYSTEMS**

Aim(s)

To gain understanding of how changing control modes, affects the behaviour of a Process control system. How plant maintenance affects the control of a process plant

Health and Safety

- *You MUST have authorisation to complete this task, and this **MUST** be supervised. Risk Assessment and Permit are required for this task.*

- *You WILL need process authorisation to complete this task.*

Task

Plant/ Controller tuning

1. Start the process plant on manual, and bring the plant to a steady control state

2. You will be shown how to access the PID tuning parameters.

3. One loop at a time, Switch the controller to Auto, and loop tune, to accurately bring the system under control, to guidelines you will be given.

Plant Maintenance

For the following, you are required to carry out activities on the running plant, and the activity listed must be carried out so as NOT to shut the plant down.

4. You are required to carry out a carry out a transmitter calibration on an active control loop.

5. You are required to perform a stroke check on a control valve on a live system

Task Analysis

Produce a written report for the above

CAROUSEL 3

Digital instrumentation, and Process Analysers

PHASE 2 INSTRUMENTS

PROJECT No	**DT1**
PROJECT TITLE	**INTRODUCTION and UNDERSTANDING OF DIGITAL TECHNOLOGY IN INSTRUMENT SYSTEMS**
R.O.A.SUBJECT AREA	**I-21 DIGITAL TECHNOLOGY**

Aim(s)

To gain a basic understanding of the application of Digital Technology in instruments systems and equipment.

Task

Using available (listed) resources, carry out research to gain a basic understanding of the following related to Digital Equipment/ systems.

- ANALOG to DIGITAL, and DIGITAL to ANALOG signal Conversion
- HART
- FIELDBUS

In your research, cover ‘what’ each is, ‘how’ each works, and the benefits when applied to use.

From your research, briefly explain the benefits of using ‘smart’ and ‘Fieldbus’ communication verses standard 4-20mA systems.

The following websites (webpages), will provide some useful information:

http://www.hartcomm.org/protocol/about/aboutprotocol_what.html

http://www.hartcomm.org/protocol/about/aboutprotocol_how.html

http://www.hartcomm.org/protocol/about/aboutprotocol_benefits.html

Task Analysis

- Produce a brief written report on the practical, and include a copy of the calibration details.

PHASE 2 INSTRUMENTS

PROJECT No	**DT2**
PROJECT TITLE	**INTRODUCTION TO SMART INSTRUMENTATION and EQUIPMENT**
R.O.A.SUBJECT AREA	**I-21 DIGITAL TECHNOLOGY**

Aim(s)

To gain practical experience using SMART calibration equipment to determine the functionality of a process measurement / control loop

Health and Safety

- Read through the project and produce a written risk assessment countersigned by your Training Officer. *You may need process authorisation to complete this task.*

Task

- You will be assigned a SMART control/ measurement loop to work on.

1. Connect the “smart” communicator into the circuit as per manufacturers’ instructions.
2. Using appropriate keys on the communicator review, and note down, the data currently saved in the memory of the transmitter.
3. Identify from this data what the input limits of the transmitter are, its minimum range within those limits and its current calibration range.
4. Calibrate the transmitter using the values and confirm that the panel (DCS) readings are accurate
5. Change the range of the transmitter (to 2 x its current) using the keypad of the communicator
6. Re - check the calibration using the ‘original’ calibration range, and note the reading (effect) on the panel (DCS)
7. Return transmitter to original range settings using communicator.
8. Use the communicator to perform a “loop test”
9. Return the system to normal
10. complete for all SMART loops on the plant.

DT2 Continued - Task Analysis

- Produce a brief written report on the practical, and include a copy of the calibration details.
- Identify (using diagrams) where in the control loop the communicator may be connected'
- Explain / summarise the differences (and benefits) with this method, over conventional methods of calibration

PHASE 2 INSTRUMENTS

PROJECT No	**D1**
PROJECT TITLE	**ARCHITECTURE OF DIGITAL CONTROL SYSTEMS**
R.O.A.SUBJECT AREA	**I-19 DISTRIBUTIVE CONTROL SYSTEMS**

Aim(s)

To gain understanding, and BASIC knowledge of the architecture and design of Digital Control Systems.

Task

Using the DVD, 'Digital Control Techniques', research the following:

1. Six benefits/ advantages of using Digital Control systems
2. Explain what is meant by a 'control algorithm', and how this affects configuring a control system.
3. Briefly explain the following control systems, including positive and negatives:
    - DDC
    - Supervisory
    - DCS
    - PLC – Programmable Controllers
4. Go through the TTE Training Rig DeltaV induction package
5. Draw a diagram to identify the component parts of the TTE Training Rig DCS system.
6. What does the term I/O mean? Describe the I/O capacity of the TTE Rig DeltaV control system.

Task Analysis

- Produce a written report to cover the above,

PHASE 2 INSTRUMENTS

PROJECT No	**D2**
PROJECT TITLE	**DCS NAVIGATION – Operator View.**
R.O.A.SUBJECT AREA	**I-19 DISTRIBUTIVE CONTROL SYSTEMS**

Aim(s)

To gain an understanding of the operating features of a typical DCS system.

You will require access to the TTE Control Rig for this task.

Health and Safety

- Read through the project and produce a written risk assessment countersigned by your Training Officer. *You may need process authorisation to complete this task.*

Task

Using the TTE DeltaV Navigation guide:

1. Log on to the DeltaV system in ‘Operator mode’
2. Load up the ‘Operator Interface’.
3. Select and navigate to a new control screen.
4. Open up an on screen controller, and switch it from auto to manual and back again. Also how to change the setpoint whilst the controller is in AUTO.
5. On the selected controller, display its configuration.
6. On the configuration screen, identify how Proportional, Integral and Derivative settings are accessed and changed.
7. Learn how alarms are displayed and how to accept alarms, and what the terms ‘LOW’, LOLO, HIGH and HIHI’ mean.
8. Learn how to access a trended output and change its time base

Task Analysis

- Produce a written report for the above

PHASE 2 INSTRUMENTS

PROJECT No	**D3**
PROJECT TITLE	**DCS NAVIGATION – Engineering Mode.**
R.O.A.SUBJECT AREA	**I-19 DISTRIBUTIVE CONTROL SYSTEMS**

Aim(s)

To gain an understanding of the 'Engineering' features, of a typical DCS system.

In this project you will explore some off the engineering features of DCS

You will require access to the TTE Control Rig for this task.

Health and Safety

- *You MUST have authorisation to complete this task, and this **MUST** be supervised. You **MUST NOT** save any activity unless specifically told to do so.*
- *You WILL need process authorisation to complete this task 8.*

Task

To begin this task, the DCS must be logged in, in Engineering Mode.

1. From the start menu, open 'DeltaV Explorer', identify what a 'NODE' is, and what this contains.
2. From the applications drop down menu, Locate and then describe what information is contained in the I/O configuration. Give examples of when this screen would be useful?
3. Select an assigned module from NODE 1, right click on it, and view its Properties. What information is available here? *Do not change any of the settings and DO NOT save anything.*
4. Under 'Node1', in the I/O menu, open this, and what does this section allow you to do.?
5. Right Click on CO3, open the properties and what does this tell you?
6. Right Click in CH08 of CO3, what does this menu allow you to do

Task Analysis

- Produce a written report for the above

PHASE 2 INSTRUMENTS

PROJECT No	**D4**
PROJECT TITLE	**BUILDING A CONTROL LOOP.**
R.O.A.SUBJECT AREA	**I-19 DISTRIBUTIVE CONTROL SYSTEMS**

Aim(s)

To gain an understanding of the 'Engineering' features, of a typical DCS system.

In this project you will see how inputs to DCS are created, accessed and displayed

You will require access to the TTE Control Rig for this task.

Health and Safety

- *You MUST have authorisation to complete this task, and this **MUST** be supervised. You **MUST NOT** save any activity unless specifically told to do so.*
- *You WILL need process authorisation to complete this task 8.*

Task

To begin this task, the DCS must be logged in, in Engineering Mode.

1. Load up, 'DeltaV graphics interface'. Open the file TTEV902. By copy/paste, add a Level indication to read the Level of Tank V902, using information from the level control for that vessel. SAVE the screen, ensuring it is saved only as TTEV902.
2. From the start menu, Open 'Operator interface', and open the screen TTEV902, note whether the indication you have created is reading.
3. **NOW COMPLETE TASK D5**.
4. Go back and DELETE the changes you have made, SAVE this.
5. Return to the Operator Interface, load up TTEV902 and check your work has been removed.

Using the above learning, you will be given the task of incorporating a new process measurement to the Training Rig. This must display on screen, and be useable

Task Analysis

- Produce a combined written report for D4 and D5

PHASE 2 INSTRUMENTS

PROJECT No	**D5**
PROJECT TITLE	**TESTING and FAULT FINDING using DCS**
R.O.A.SUBJECT AREA	**I-19 DISTRIBUTIVE CONTROL SYSTEMS**

Aim(s)

To gain experience of using a typical DCS system to solve instrument system related faults.

In this project you will see how inputs to DCS are accessed and displayed

You will require access to the TTE Control Rig for this task.

Health and Safety

- *You MUST have authorisation to complete this task, and this **MUST** be supervised. Risk Assessment and Permit are required for this task.*

- *You WILL need process authorisation to complete this task.*

Task

You need to request a 'Control Loop' to work on:

1. Locate the 'data'/ 'wiring diagrams'/ 'I/O information' relating to the loop you have created in **TASK D4**.

2. Simulate an input to the DCS for the loop you created (at the DCS I/O rail) using appropriate test equipment and display the readings.

3. Make 25% step changes in the output from the DCS and monitor it using appropriate test equipment

4. Simulate an input to the DCS by calibrating the associated transmitter and display the readings

5. Make 25% step changes in the output from the DCS and monitor it using appropriate test equipment.

6. Open the trend screen for this loop, and note the changes made.

Task Analysis

- Produce a written report for the above, explaining how fault finding may be carried out using information from the screens.

PHASE 2 INSTRUMENTS

PROJECT No	**A1**
PROJECT TITLE	**ANALYSER SAMPLE SYSTEMS**
R.O.A.SUBJECT AREA	**I-14 PROCESS ANALYSERS**

Aim(s)

To gain an understanding through research, of a variety of commonly used process analyser Sample Systems as used on a process plant.

Task

- Identify the purpose of the sample system
- You will be shown a sample conditioner cabinet
    1. Produce a diagram of the layout and Identify the component parts
    2. Suggest what routine maintenance you might expect to carry out on them.
    3. Investigate other methods for obtaining and transporting samples

Task Feedback

- Produce a brief written report and a copy of the 'Process Analysers' questionnaire.

PHASE 2 INSTRUMENTS

PROJECT No	**A2**
PROJECT TITLE	**PRINCIPLES OF OPERATION**
R.O.A.SUBJECT AREA	**I-14 PROCESS ANALYSERS**

Aim(s)

To gain an understanding through research of the theory and application of a range of commonly used process analysers.

Using the 'Process Analysers' questionnaire, research the operation and uses of different types of process analyser

Task

1. Using course notes, manufacturers manuals, and the internet, investigate the principle of operation of the following analysers:-

   Oxygen (not dissolved oxygen).
   Conductivity
   Radiation Absorption
   Hygrometry
   Thermal Conductivity
   Liquid Density

2. Identify the component parts of each

3. Briefly Determine the calibration procedure and locate where the adjustments are made.

Task Feedback

- Complete the 'Process Analysers' questionnaire.

PHASE 2 INSTRUMENTS

PROJECT No	**A3**
PROJECT TITLE	**pH**
R.O.A.SUBJECT AREA	**I-14 PROCESS ANALYSERS**

Aim(s)

To gain an understanding of the theory, and application of the measurement of pH.

Health and Safety

- Read through the project and produce a written risk assessment.

Task

1. Familiarise yourself with the portable pH meter.
2. Carry out a Buffer check on the meter.
3. Take a sample of water from the outside training rig.
4. Use the meter to check the pH of your training rig water sample and tabulate your results.
5. Based on the outside training rig, design an appropriate installation with process line diagram, which would allow for the continuous measurement of pH of a flowing product. (note: the pH meter will need to be removed for routine buffer checks).

Task Feedback

- Produce a brief written report on the practical, including your design
- Explain why you chose this location
- Write a simple flow diagram format procedure for carrying out a buffer check on the system you have designed.

PHASE 2 INSTRUMENTS

PROJECT No	**A4**
PROJECT TITLE	**CHROMATOGRAPHY**
R.O.A.SUBJECT AREA	**I-14 PROCESS ANALYSERS**

Aim(s)

To gain an understanding through research of the theory and application of Chromatography analysers.

Health and Safety

- Read through the project and produce a written risk assessment countersigned by your Training Officer.

Task

1. Identify the component parts of the analyser

2. Power up the analyser and copy down the configuration table.

3. Trace and explain the different stages the sample takes before and including analysis

Task Feedback

- Produce a brief written report

PHASE 2 INSTRUMENTS

PROJECT No	**A5**
PROJECT TITLE	**LIQUID CONDUCTIVITY**
R.O.A.SUBJECT AREA	**I-14 PROCESS ANALYSERS**

Aim(s)

To gain an understanding of the theory, and application of the measurement of Liquid Conductivity.

Health and Safety

- Read through the project and produce a written risk assessment.

Task

1. Familiarise yourself with the location of the Rig Liquid Conductivity meter.
2. Check the reading on the Conductivity meter local indicator, and also on the DCS screen.
3. Take a sample of water from the outside training rig.
4. Use a laboratory meter to check the Conductivity of your training rig water sample.
5. Tabulate/ compare your results ‘Lab’ verses ‘Onstream’.
6. Based on the current training rig system, suggest a modified design for installation which would allow for the continuous measurement of conductivity of a flowing product. (note: the meter will need to be removed for routine checks).

Task Feedback

- Produce a brief written report on the practical, complete with results table, and including your design

CAROUSEL 4
Control and Shutdown Valves

PHASE 2 INSTRUMENTS

PROJECT No	**V1**
PROJECT TITLE	**REMOVE CONTROL VALVES**
R.O.A.SUBJECT AREA	**I-16 CONTROL AND SHUTDOWN VALVES**

Aim(s)

To gain experience in removing and refitting Control Valves to a Live Process Plant.

You will require access to the TTE Control Rig for this task.

Health and Safety

- *Risk Assessment and Permit are required for this task.*
- *You WILL need process authorisation to complete this task.*

Task

You need to request a 'Control Loop' to work on:

1. Working in small teams, you will be allocated a control valves on the rig to work on.

2. Obtain as much information / technical information about the control loops and valves as available.

3. Prepare for valve removal, by Liaising with operators, have the control loop placed onto manual control, and any associated control valve bypass to be operated.

4. Isolate any air supplies, and then safely remove the valve from the rig. This procedure **MUST** take into account that the valve may be refitted by a third party who has no knowledge of valves, or the system.

5. Label the Valve**,** and provide any technical information with it to assist its refit,

Task Feedback

- Produce a written report for the above and include a copy of your Permit to Work.

PHASE 2 INSTRUMENTS

PROJECT No	**V2**
PROJECT TITLE	**VALVE OVERHAUL**
R.O.A.SUBJECT AREA	**I-16 CONTROL AND SHUTDOWN VALVES**

Aim(s)

To gain understanding of the operation of and experience in overhauling Control Valves.

Practical to be carried out on:

Bellows Seal control valve
Gland Seal Control Valve
Ball Valve
Diaphragm Valve
Butterfly Valve

Health and Safety

- *Risk Assessment is required for this task.*

Task

You need to request a 'Control Valve' to work on:

1. Completely disassemble valve to component parts
2. Identify each component and their purpose
3. Check the condition of the parts, paying particular attention to the Plug/Seat.
4. Re-assemble valve, and ensure that the plug/seat are re-ground.
5. Calibrate or function check valve as appropriate
6. Check the valve to ensure it is NOT 'passing'.
7. Perform a leak check, and pressure test on the valve

Task Feedback

Produce a written report to include the following:-

- Valve testing procedure for on the bench and in-situ.

- What would you do differently when overhauling Gland and Bellows seal valves, also between control valves and piston (spring assisted) shutdown valves
- Show by means of diagram how to incorporate a control valve and shutdown valve into a control/ shutdown system.
- Explain with graphical support, how Plug flow characteristics affect control
- Explain Direct / Reverse action,
- What would you look for when testing a valve, and describe some of the common faults.

PHASE 2 INSTRUMENTS

PROJECT No	**V3**
PROJECT TITLE	**REFIT CONTROL VALVES**
R.O.A.SUBJECT AREA	**I-16 CONTROL AND SHUTDOWN VALVES**

Aim(s)

To gain experience in refitting a Control Valve to a Live Process Plant.

You will require access to the TTE Control Rig for this task.

Health and Safety

- *Risk Assessment and Permit are required for this task.*
- *You WILL need process authorisation to complete this task.*

Task

You need to request a 'Control Loop' to work on:

Working in small teams, you will be allocated a control valve on the rig to work on.

1. Obtain as much information / technical information about the control loop and valve as available.
2. Prepare for valve refit, by Liaising with operators, ensure the control loop placed onto manual control, and any associated control valve bypass should be operated.
3. Safely reconnect the valve into the pipeline, ensuring the valve is in the correct way round, and the Air Fail Action of the valve supports this.
4. Reconnect the supply and signal, and De-Isolate.
5. Stroke check the valve
6. Check for leaks
7. Have operators re-commission the valve for service, remove any bypass and isolations.

Task Analysis

- Produce a brief written report on the practical

PHASE 2 INSTRUMENTS

PROJECT No	**V4**
PROJECT TITLE	**STROKE CHECKING**
R.O.A.SUBJECT AREA	**I-16 CONTROL AND SHUTDOWN VALVES**

Aim(s)

To gain experience in 'Stroke Checking' Control Valves in different situations.

Health and Safety

- *Risk Assessment is required for this task.*
- *Permit to Work and Process authorisation is required for Task 2*

Task 1

This practical may be carried out on from one of the valves from the previous practical's:

1. In pairs (small teams) stroke check a control valve using workshop test equipment, note down your findings and any corrective action taken

Task 2

2. Stroke check a control valve connected into a control loop using the DCS controller, note down your findings and any corrective action taken

3. Stroke check a control valve connected into a control loop using a mA source (loop calibrator) at the I to P, note down your findings and any corrective action taken

4. Stroke check a Valve from single loop controller

Task Analysis

5. Produce a brief written report on the practical, comparing both methods.

PHASE 2 INSTRUMENTS

PROJECT No	**V5**
PROJECT TITLE	**POSITIONERS**
R.O.A.SUBJECT AREA	**I-16 CONTROL AND SHUTDOWN VALVES**

Aim(s)

To gain understanding of the operation of the main types of valve positioner.

Health and Safety

- *Risk Assessment is required for this task.*

Task

1. Define the role of the valve positioner.
2. Study the operation and application of 'motion balance, 'force balance' and digital valve positioners.
3. Understand the difference between direct and reverse action.
4. Strip down a pneumatic motion balance positioner
5. Identify the component parts of a motion balance positioner
6. Re-assemble the positioner
7. Fit a motion balance positioner (pneumatic or electronic) to a control valve
8. Ensure that the valve operates correctly
9. Strip down a force balance positioner
10. Identify the component parts of a force balance positioner
11. Fit a force balance positioner to a control valve
12. Ensure that the valve operates correctly
13. Research digital valve positioner(s) and their benefits.
14. Check the operation of a digital valve positioner

Task Analysis

- Produce a brief written report on the practical

PHASE 2 INSTRUMENTS

PROJECT No	**V6**
PROJECT TITLE	**UNDERSTANDING FLOW CHARACTERISTICS**
R.O.A.SUBJECT AREA	**I-16 CONTROL AND SHUTDOWN VALVES**

Aim(s)

To gain understanding of the effects of altering flow characteristics of a control valve..

You will require access to the TTE Control Rig for this task.

Health and Safety

- *Risk Assessment and Permit are required for this task.*
- *You WILL need process authorisation to complete this task.*

Task

You need to request a Process Control Loop and 'Control Valve' to work on:

Working in small teams, you will be allocated a control valve on the rig to work on.

1. Obtain as much information / technical information about the control loop and valve as available.
2. Liaising with operators, ensure the control loop placed onto manual control, and any associated control valve bypass should be operated.
3. Perform a stroke check of the valve, but also plot a graph of valve position verses flow rate
4. Isolate the valve and remove it
5. Replace the plug with a different style
6. Refit the valve
7. Perform a stroke check of the valve, but also plot a graph of valve position verses flow rate.
8. Analyse the graphs and try to determine the plug style from the characteristic

PHASE 2 INSTRUMENTS

PROJECT No	**V7**
PROJECT TITLE	**SHUTDOWN VALVES**
R.O.A.SUBJECT AREA	**I-16 CONTROL AND SHUTDOWN VALVES**

Aim(s)

To gain understanding of / and experience overhauling shutdown valves.

Health and Safety

- *Risk Assessment is required for this task.*
- **YOU MUST BE ABLE TO HOLD and RELEASE THE SPRING TENSION**

Task

You need to request a 'Shutdown Valve' to work on:

1. Completely disassemble a shutdown valve to component parts
2. Identify each component and their purpose
3. Check the condition of the parts
4. Re-assemble valve.
5. Calibrate or function check as appropriate
6. Check the valve to ensure it is NOT 'passing'.
7. Perform a leak check, and pressure test on the valve

Task Analysis

Produce a written report and include the following:-

- What precautions MUST be observed when overhauling shutdown/ trip valves.
- What applications in addition to trip systems, could this type of valve be used in.

PHASE 2 INSTRUMENTS

PROJECT No	**V8**
PROJECT TITLE	**SOLENOID VALVES**
R.O.A.SUBJECT AREA	**I-16 CONTROL AND SHUTDOWN VALVES**

Aim(s)

To gain understanding of / and experience overhauling shutdown valves.

Health and Safety

- *Risk Assessment is required for this task.*

Task

You need to request a 'Solenoid Valve' to work on:

1. Completely disassemble a solenoid valve to component parts
2. Identify each component and their purpose
3. What is meant by 3 Port and 5 Port , as related to Solenoid valves
4. Check the condition of the parts
5. Re-assemble valve.
6. Function check as appropriate
7. Connect up a Trip Valve. In the air supply line, install the Solenoid Valve you have worked on. Check the operation of the trip valve, and note the operation of the trip valve.

Task Analysis

Produce a written report and include the following:-

- What precautions MUST be observed when overhauling shutdown/ trip valves.
- What applications in addition to trip systems, could this type of valve be used in.
- Use the internet/ other resources to identify other 'types' and 'styles' of solenoid valve design.

CAROUSEL 5

Safety Systems

PHASE 2 INSTRUMENTS

PROJECT No	**S1**
PROJECT TITLE	**TRIP AMPS and Alarm initiation devices**
R.O.A.SUBJECT AREA	**I-20 SHUTDOWN SYSTEMS DESIGN AND CONSTRUCTION**

Aim(s)

To gain an understanding of how plant alarms are initiated, and the devices commonly used for this purpose, and to see how these relate to the design of Plant Shutdown/ Trip systems.

Health and Safety

- *Risk Assessment is required for this task.*

Task

1. Calibrate a trip amp (amplifier)
2. Set a trip amp up to trip on 75% rising
3. Using appropriate test equipment confirm the correct operation of the trip amp
4. Modify the set up to make the device 75% falling
5. Calibrate a pressure Switch
6. Set a Pressure Switch up to trip on 25% falling
7. Using appropriate test equipment confirm the correct operation of the Pressure Switch
8. Modify the set up to make the device 25% rising
9. Calibrate an Alarm Gauge
10. Set an Alarm Gauge up to trip on 55% rising
11. Using appropriate test equipment confirm the correct operation of the Alarm gauge

Task Analysis

- Produce a brief written report on the practical

PHASE 2 INSTRUMENTS

PROJECT No	**S2**
PROJECT TITLE	**FUNCTIONAL LOGIC DRAWINGS and SHUTDOWN 'TRIP' SYSTEM DESIGN**
R.O.A.SUBJECT AREA	**I-20 SHUTDOWN SYSTEMS DESIGN AND CONSTRUCTION**

Aim(s)

To gain experience and basic understanding of Functional Logic Diagrams, and how these are applied in the design of Plant Shutdown/ Trip systems.

Health and Safety

Risk Assessment is required for this task.

Task

For this project you are required to make drawings

You will be assigned a section of plant to study.

1. You are required to study/ analyse the section of plant. You need to look at how this section of plant impacts on other areas, and how other areas impact of this.

2. You need to come up with a set of possible 'worst case' scenario's and from these, design a suitable trip system which provides protection for that section of plant.

3. You need to present your design as a functional logic diagram, using appropriate symbols, and giving reasons for you design.

Task Analysis

- Produce a brief written report on the practical

PHASE 2 INSTRUMENTS

PROJECT No	**S3**
PROJECT TITLE	**SHUTDOWN SYSTEM DESIGN using RELAY LOGIC (1)**
R.O.A.SUBJECT AREA	**I-20 SHUTDOWN SYSTEMS DESIGN AND CONSTRUCTION**

Aim(s)

To gain understanding of the design and testing of Plant Shutdown/ Trip systems.

Health and Safety

- *Risk Assessment is required for this task.*

Task

For this project you are required to make drawings

1. You are now required to draw/ design a 1 out of 2 trip system, using relay logic. The diagram must be a full ladder diagram, and ALL contact connections etc must be drawn. The system must include:

    - Manual Reset
    - Visible Indication of the output when the system has tripped.
    - Ability to test the system without impacting on the plant
    - The system has 2 x 8pin relays and 1 x 11 pin relay

2. From your design, construct the complete shutdown/ alarm system on the bench including all unit switches, and input / output devices.

    Input 1 – a high alarm using pressure switch at 80%
    Input 2 – a low alarm using trip amplifier set at 20%

3. Once connected, carry out necessary calibration and testing to enable the system to operate to the above settings.

Task Analysis

- Produce a brief written report on the practical, and include your diagram(s)

PHASE 2 INSTRUMENTS

PROJECT No	**S4**
PROJECT TITLE	**SHUTDOWN SYSTEM DESIGN using RELAY LOGIC (2)**
R.O.A.SUBJECT AREA	**I-20 SHUTDOWN SYSTEMS DESIGN AND CONSTRUCTION**

Aim(s)

To gain understanding of the design and testing of Plant Shutdown/ Trip systems.

You will require access to the Process Control Rig in workshop 9 for this task

Health and Safety

- *Risk Assessment is required for this task.*

Task

A Trip system is required on the storage tank T128 located on the process control rig in workshop 9.

For this project you are required to make drawings

1. You are now required to draw/ design a 1 out of 2 trip system, using relay logic. The diagram must be a full ladder diagram, and ALL contact connections etc must be drawn. The system must include:

    - Manual Reset
    - Manual Trip Switch
    - Visible Indication of the output when the system has tripped.
    - Ability to test the system without impacting on the plant
    - The system must use 4 x 8pin relays

2. From your design, construct the complete shutdown/ alarm system on the bench including all unit switches, and input / output devices.

    Input 1 – a high alarm using pressure switch at 80%
    Input 2 – a low alarm using pressure switch set at 20%

3. You must now complete Task 7

4. Using the procedure you have drawn up, carry out calibration and testing to enable the system to operate to the above settings.

Task Analysis

Produce a brief written report on the practical, and include your diagram(s)

PHASE 2 INSTRUMENTS

PROJECT No	**S5**
PROJECT TITLE	**SHUTDOWN SYSTEM DESIGN using HIMA LOGIC**
R.O.A.SUBJECT AREA	**I-20 SHUTDOWN SYSTEMS DESIGN AND CONSTRUCTION**

Aim(s)

To gain experience and basic understanding of HIMA LOGIC units, and how these are applied in the design of Plant Shutdown/ Trip systems.

Health and Safety

- *Risk Assessment is required for this task.*

Task

1. Design a '1 out of 3' Shutdown System for use with a Hima logic unit, incorporating 3 different methods of generating an input. (Pressure switch, trip amplifier and alarm gauge)

2. Use the proformer sheet to identify the inputs and outputs

3. Following the design, construct the complete shutdown/ alarm system on the bench including all unit switches, and input / output devices.

4. Once connected, carry out necessary calibration and testing to enable the system.

5. Explain the design difference between a '2 out of 3' Shutdown System and 1 out of 3.

6. What is meant by a 'Tandem' system

Task Analysis

- Produce a brief written report on the practical, and include your diagram(s), explaining what the connections are: ie XE/XF TE/TF etc

- Explain the difference between relay and solid state logic systems (i.e.; how they operate)

- Give examples of the importance of Plant interlock systems

PHASE 2 INSTRUMENTS

PROJECT No	**S6**
PROJECT TITLE	**Shutdown/ Trip system PROCEDURES**
R.O.A.SUBJECT AREA	**I-20 SHUTDOWN SYSTEMS DESIGN AND CONSTRUCTION**

Aim(s)

To gain experience and basic understanding of how Shutdown/Trip system Procedures are set up.

Health and Safety

- *Risk Assessment is required for this task.*

Task

1. For the system you have created in Task 4, devise a suitable full 'step by step' procedure for testing the full system.

2. Return to Task 4 and use the procedure to test the system

Task Analysis

- Produce a brief written report on the practical
- Research what Legislation supports the need for/ and use of Shutdown/ trip systsems

PHASE 2 INSTRUMENTS

PROJECT No	**S7**
PROJECT TITLE	**INTRODUCTION to TRIP CHECKING PLANT SYSTEMS**
R.O.A.SUBJECT AREA	**I-20 SHUTDOWN SYSTEMS DESIGN AND CONSTRUCTION**

Aim(s)

To gain experience in carrying out Shutdown/Trip system testing by following formalised Procedures

Health and Safety

- *Risk Assessment and Permit are required for this task.*
- *You WILL need process authorisation to complete this task.*

Task

1. Obtain TRIP Check Procedure for the Trip units in workshop 9
2. Carry out Trip Checks in workshop 9, on the following systems:
    - Low Level
    - High Temperature
    - Low Flow
    - Low Pressure

Task Analysis

- Supply FULLY completed copies of each Trip Check procedure – these MUST be signed off by the T.O
- Risk Assessments and Permits to be supplied

PHASE 2 INSTRUMENTS

PROJECT No	**S8**
PROJECT TITLE	**TRIP CHECKING on operating PLANT SYSTEMS**
R.O.A.SUBJECT AREA	**I-20 SHUTDOWN SYSTEMS DESIGN AND CONSTRUCTION**

Aim(s)

To gain experience in carrying out Shutdown/Trip system testing by following formalised Procedures, on a running/ operational Plant

Health and Safety

- *Risk Assessment and Permit are required for this task.*
- *You WILL need process authorisation to complete this task.*

Task

1. Obtain TRIP Check Procedures for the Trip Training Rig Trip Systems
2. Carry out Trip Checks on the Training Plant systems:

Task Analysis

- Supply FULLY completed copies of each Trip Check procedure – these MUST be signed off by the T.O
- Risk Assessments and Permits to be supplied

CAROUSEL 6

Maintaining a Process Plant

PHASE 2 INSTRUMENTS

PROJECT No	**H1b**

PROJECT TITLE	PROTECTION IDENTIFICATION
R.O.A.SUBJECT AREA	I-15 HAZARDOUS AREA EQUIPMENT

Aim(s)

Given the importance of this subject, the aim is to revisit the fundamental principles of, 'Hazardous Area Equipment', as used in Instrumentation.

Task

In this task you will investigate, recognise and demonstrate understanding of:

1. The need for Hazardous area equipment.

2. Legislation, and legal obligations. (HSE, DSEAR, ATEX, EPS)

3. The definition of a Hazardous Area, including what is meant by the terms:

    - Flashpoint
    - Auto – Ignition
    - Flammable Mixture
    - Lower Explosive Limit
    - Upper Explosive Limit

4. The classifications (zones) of Hazardous areas

5. Types of protection required for different hazardous conditions.

6. Gas groups and Temperature Classification

7. How Hazardous Area Equipment is identified and briefly explain the marking system, and to recognise equipment

8. The theories/ and difference(s) between Flameproof (Ex.d) and Intrinsically Safe (Ex ia/Ex ib).

9. Measures that can be taken to protect 'mains operated' equipment, (Ex p)

10. Working on equipment in hazardous areas. (Calibration, replacing equipment)

11. System Certificates.

Task Analysis

- Complete the written 'Hazardous Area Equipment' questionnaire.

PHASE 2 INSTRUMENTS

PROJECT No	H2b

PROJECT TITLE	**FAULTFINDING on Hazardous Area Equipment**
R.O.A.SUBJECT AREA	**I-15 HAZARDOUS AREA EQUIPMENT**

Aim(s)

Given the importance of this subject, the aim is to revisit the fundamental principles and be able to identify 'Hazardous Area Equipment', as used in Instrumentation.

Health and Safety

- Read through the project and produce a written risk assessment countersigned by your Training Officer.

Task

In a given workshop / or work area:

1. Identify items of equipment which are I.S (Ex ia)
2. Identify items of equipment which are Ex.d (Flameproof)
3. Look for faults on given systems, and Identify any faults you may find which compromise the protection.
4. Explain how the faults found can compromise protection
5. Identify the different types and styles of cable glanding used in I.S and Non I.S systems.

Task Analysis

- Produce a brief written report on the practical, and provide evidence of the above

PHASE 2 INSTRUMENTS

PROJECT No	**M1**
PROJECT TITLE	**RIG 1**
R.O.A.SUBJECT AREA	**I-22 MAINTENANCE PROCEDURES**

Aim(s)

The purpose of this project is to **TEST** 'your' knowledge and ability under the pressure of working in a real life situation.

To gain an understanding and appreciation of working as an instrument technician, to maintain a running process plant.

Under **NO** circumstances are you to cause improper plant shutdown.

Task

During the course of this carousel, you will be responsible for maintaining the TTE Instrument systems on the TTE Training Rig. You will work as if you were a technician on site, and work in the roles traditionally carried out by an instrument technician. You **MUST** keep a daily log of the tasks you perform.

These roles will be broken into

- Trip Systems Checking
- Plant Breakdowns
- Routine Maintenance

1. You will be given a variety of maintenance activities to carry out.

2. For each task you will need a permit, in order to get the permit you will undergo questioning from the operator in charge of the process plant.

   Tasks must be carried out in pairs. If it is your task, you must LEAD and carry out the task(s).

   You will need to understand what you will be doing during the maintenance task(s) and what consequence(s), if any, your actions may have on the control of the plant. Such consequences may be:- the effects of a control loop on Auto, bringing in a plant alarm, initiation of a plant trip, need for bypassing alarms or valves, or leakage of process media.

   You will need to tell the operator how such consequences may be minimised and managed.

   If the operator is not satisfied that you fully understand the job, you **will not** be issued with a permit.

PROJECT M1 Continued

3. You must follow any/all standard procedures while carrying out the task

4. You **MUST** report back to the operator on completion of each task.

5. All permits MUST be signed off on completion of the task(s)

6. A written maintenance reports MUST be completed for each task and the maintenance log completed.

Health and Safety

- A written risk assessment and Permit will be required for **each** task, the Permit **MUST** be countersigned by your Training Officer.
- At NO point during the task are you allowed to leave the plant or items of equipment in an unsafe condition, or were ability to control the plant is compromised.
- You must FULLY liaise with plant operators during the tasks

Task Feedback

- Produce a log, detailing the tasks you have carried out. Include copies of ALL permits, data sheets etc that you have used during these tasks.

TASK LIST

The following items (of maintenance activity) must be completed, during the final carousel, and demonstrated as proof of competence:

Task	Description/ Demonstration	Date:	Learner	TO
Pipe bending				
Making off Pipe				
Make off Cable gland				
Use of multi-meter Ω / mA / volts	Ω : mA : volts :			
Use of mA signal injector				
Able to calibrate pneumatic transmitter	Bench: In-situ:			
Able to calibrate electronic transmitter	Bench: In-situ			
Strip down and rebuild range of control valves				
Stroke check control valves	Bench In-situ			
Commission control loop				
Remove and refit control valve to live plant				
Complete 'Trip Check' on live plant				
Work on Level measurement system				
Work on Flow measurement system				
Work on Temp' measurement system				
Work on Pressure measurement system				
Work on I.S loop				
Install/ replace equipment				
Fault find on a control loop				
Use wiring diagrams				

MAINTENANCE LOG

Date/ Time:	Description of Task:	Signature of Completion