Cairo University
Faculty of Engineering
Mech. Power Department

دبلوم تطبيقات التحكم الأوتوماتيكى فى نظم القوى الميكانيكية

MEP 574 Using Virtual Lab Applications for Pumping and Tank Filling plants

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What do we study? **ملاحظة:** هذا ليس مقررلتدريس نظرية المضخات للمبتدئين ولكن مقررمتقدم للتدريب على نظم التحكم الأوتوماتيكى لهذه المحطات

مكق 574 تطبيقات المعامل الإفتراضية فى التحكم فى محطات المضخات الطاردة المركزية ومحطات الرفع وتغذية الخزانات:

Part I: Interactive Auto Control System for Industrial pumping plant with two Parallel or Series Centrifugal Pumps:

Part II: Interactive Automatic Control System for filling different vertical tanks with liquids:

يتضمن المقرر دراسة والتعرف على وتحليل عناصرالعديد من مكونات وأجهزة ومعدات نظم التحكم الآلى المستخدمة فى محطات المضخات المركزية المستخدمة فى رفع السوائل وكذلك محطات تغذية وملء الخزانات. كما يتضمن المقررذلك دراسة حالة تطبيقية من خلال برنامج معامل إفتراضية تفاعلى للتحكم الأوتوماتيكى وتشغيل وإدارة كافة أجزاء محطة للرفع تتضمن عدد 2 مضخة مركزية تعملان على التوالى أوالتوازى أو كل على حدة حسب ظروف التشغيل المحددة والمخرجات المطلوبة .

What do we have in the Industrial Pumping and Tank Filling Plant?

Part I: Interactive Automatic Control System for an Industrial pumping plant with two Parallel or Series Centrifugal Pumps: This is an interactive computer-based training course that includes an investigation, a virtual computer simulation and flow visualization. The course is designed to give the participant a broad based understanding of the most important concepts of practical automatic control and real thermo-fluid processes existing in Industrial pumping station. The station includes two centrifugal pumps which may work separately or work as pairs in parallel or in series. The pumps are provided with separated controls and instrumentation. Each of the two pumps can be operated independently from the other pump. The simulation allows changing all the operation conditions of each pump including the rpm, the inlet suction head, and the output discharge. This allows investigation of the H-Q curves of the plant for all possible different flow conditions. Also the characteristic H-Q curve of each pump can be obtained at full load conditions. The simulation includes many critical control alarms, input/output signals, operation and instrumentation parameter-boards, diagnostic page tools, error-report filling, help/trouble-shooting menus and Thermal Balance Calculations and Plotting tools.

Part II: important concepts of practical automatic control and real fluid processes existing in filling different vertical tanks with liquids. The plant includes a venture-meter at output and flow control valve at inlet. The simulation allows adjusting flow/speed values, working data, and venture meter values. The tank filling time is calculated and the diagram of head-pressure is plotted, presented and updated instantaneously. The simulation includes many critical control alarms, input/output signals, operation and instrumentation parameter-boards, diagnostic page tools, error-report filling, help/trouble-shooting menus and Thermal Balance Calculations and Plotting tools.

Save | New table | Diagnostic | Diagrams

% OPEN VALVE 46%

% OPEN VALVE 39%

% OPEN VALVE 36%

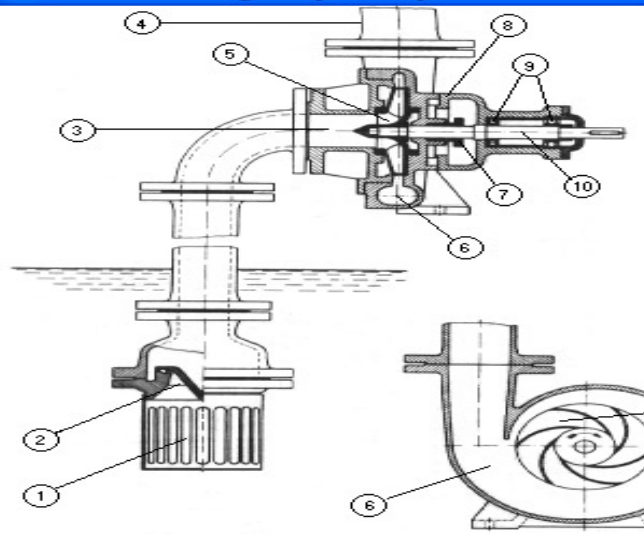
HEIGHT SUCTION 1.3 m

DIFFERENCE IN HEIGHT 11.8

ON Pump 1 OFF

ON Pump 2 OFF

Centrifugal pump section



1. Filter
2. Nonreturn valve
3. Suction pipeline
4. Delivery pipeline
5. Impeller
6. Cochlea
7. Seal
8. Casing
9. Bearings
10. Shaft

Exit

Centrifugal pump by one impeller

FLOW/SPEED VALUES

Output flow m³/s .: 0.28

Output speed m/s .: 14.01

Input flow m³/s .: 0.50

VENTURI METER VALUES

Liquid density kg/m³ .: 13,590

Throttling ratio .: 1.2

Difference in height m .: 0.350

Info

Exit

Speed

Accelerated Normal

WORKING DATA

Tank volume m³ .: 50

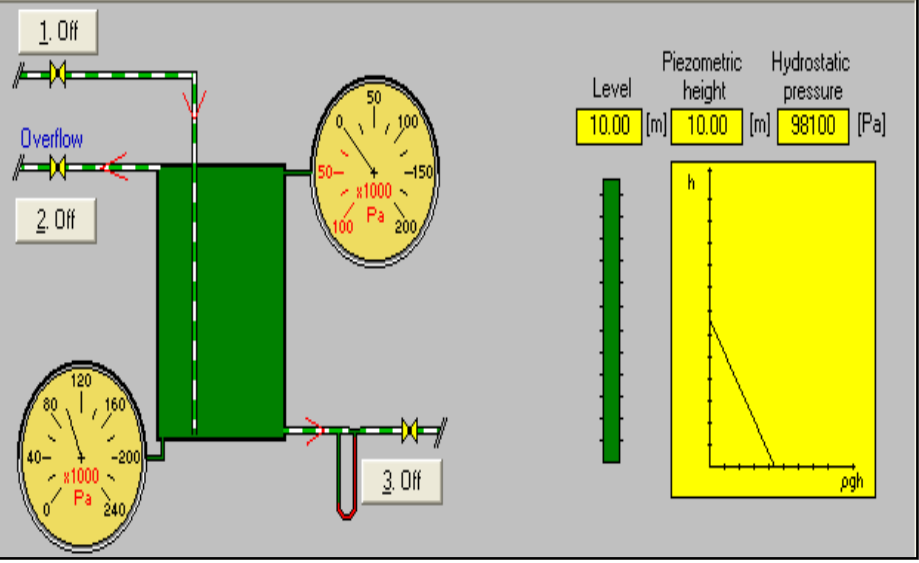
Tank height m .: 10

Liquid density kg/m³ .: 1000

Section of outflow m² .: 0.020

THE FILL TIME

Hours, minutes, seconds .: 00.02.50



Course Specifications & Basic Information

1. Title:	Using Vir.Lab Applications for Control of Industrial Pumping & Tank Filling plants			Code:MEP574
2.Credit hrs per week	Lectures= 3 hours per week	Tutorial= 0.0	Practical= 0.0	Total=3 Cr.Hrs

B- Professional Information

1. Course description: Overall Aims:

This is interactive computer-based training course that includes investigation, a virtual computer simulation& flow visualization. The course is designed to give the participant a broad based understanding of the most important concepts of practical automatic control and real thermo-fluid processes existing in Pumping & Tank Filling Plants.

Part I: Interactive Automatic Control System for an Industrial pumping plant with two Parallel or Series Centrifugal Pumps: This is an interactive computer-based training course that includes an investigation, a virtual computer simulation and flow visualization. The course is designed to give the participant a broad based understanding of the most important concepts of practical automatic control and real thermo-fluid processes existing in Industrial pumping station. The station includes two centrifugal pumps which may work separately or work as pairs in parallel or in series. The pumps are provided with separated controls and instrumentation. Each of the two pumps can be operated independently from the other pump. The simulation allows changing all the operation conditions of each pump including the rpm, the inlet suction head, and the output discharge. This allows investigation of the H-Q curves of the plant for all possible different flow conditions. Also the characteristic H-Q curve of each pump can be obtained at full load conditions. The simulation includes many critical control alarms, input/output signals, operation and instrumentation parameter-boards, diagnostic page tools, error-report filling, help/trouble-shooting menus and Thermal Balance Calculations and Plotting tools.

Part II: important concepts of practical automatic control and real fluid processes existing in filling different vertical tanks with liquids. The plant includes a venture-meter at output and flow control valve at inlet. The simulation allows adjusting flow/speed values, working data, and venture meter values. The tank filling time is calculated and the diagram of head-pressure is plotted, presented and updated instantaneously. The simulation includes many critical control alarms, input/output signals, operation and instrumentation parameter-boards, diagnostic page tools, error-report filling, help/trouble-shooting menus and Thermal Balance Calculations and Plotting tools.

2. Intended Learning Outcomes of Course (ILOs):

a) Knowledge and Understanding:

Having successfully completed this course, the post-graduate student should have knowledge and understanding of:

- Theories, Information, sciences and specialized technologies in the fields of automatic control of mechanical power equipments and systems of Industrial Pumping and Tank filling Plants.
- Moral, legal essentials &quality control principals related to the graduate's professional practices in automatic control fields.
-Various effects of eng. professional practices of Pumping & Tank Filling Plants on different components of the environment.
-Methods used for emission/pollution control and energy rationalization and maximization of the benefits of Industrial Pumping and Tank Filling Plants.

b) Intellectual Skills:

Having successfully completed this course, the student should have the ability to do:

-Identify scientific & practical problems related to auto. control of Industrial Pumping & Tank filling Plants.

- Analyze & propose professional, technical solutions and algorithms for automatic control problems.

- Analytical reading of research &report topics related to control of Industrial Pumping & Tank filling Plants.

- Evaluate and estimate various risks involved in professional practices related to of Industrial Pumping & Tank filling Plants.

-Take effective actions and professional decisions in accordance with and/or based on available data and technical information.

c) Professional and Practical Skills:

Having successfully completed this course, the student should have the ability to do:

Apply professional and practical skills in the fields of automatic control of Industrial Pumping & Tank filling Plants.

Execute short term project and write engineering technical report that involves graphs, charts, and diagrams.

Perform professional presentation and suggest possible alternative solutions for automatic control problems of Industrial Pumping & Tank filling Plants.

Write technical requirements & selecting engineering reference standards for Industrial Pumping & Tank filling Plants.

d) General and Transferable Skills:

Having successfully completed this course, the student should have the ability to do:

-Perform engineering calculations, draw feed-back control circuits, block diagrams, graphical presentation of experimental data, and perform data-regression analysis.

-Transfer knowledge, Work in group, & Communicate in written & oral forms, in English.

- Use IT& evolutionary technological tools& PC applications (Excel, Mat lab, Virtual labs, .etc).

- Prepare & write reports, Manipulate & sort data, Think logically, and continuous self-E-learning.

- Identify practical problems, compare between different technologies for measurement systems.

-Organise & manage time & resources effectively; for short-term and longer-term commitments.