



دبلوم تطبيقات التحكم الأتوماتيكي في نظم القوى الميكانيكية

MEP 573 Using Virtual Lab Applications for Industrial Diesel Engine Brake Unit

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What do we study? **ملاحظة:** هذا ليس مقررتدريس دورةمحركات الديزل للمبتدئين ولكن **مقررمتقدم** للتدريب على نظم التحكم الأتوماتيكي لهذه المحركات

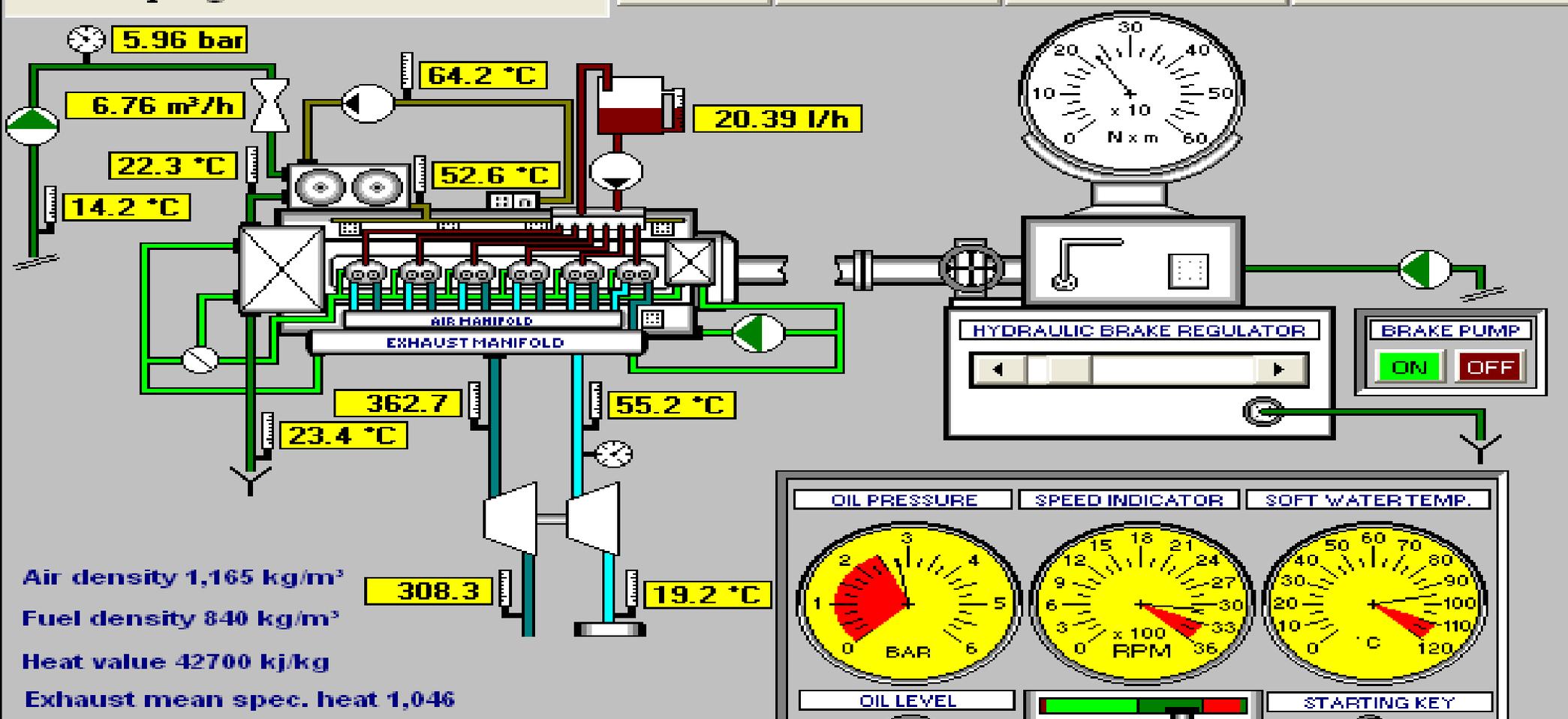
مق 573 تطبيقات المعامل الافتراضية في دراسة وتحليل خصائص محركات الإحتراق الداخلي: System Interactive Automatic Control

for an Industrial 6-cylinder, turbo-charger, Diesel engine plant with a hydraulic power brake unit:

دراسة والتعرف على وتحليل عناصر ومكونات وأجهزة ومعدات نظم التحكم الآلي المستخدمة في تحديد الخصائص ومواصفات الأداء العملية **actual performance characteristics** لمحركات الديزل من خلال عمل القياسات على وحدة الفرملة الهيدروليكية **hydraulic brake unit**. كما يتضمن المقرر كذلك دراسة حالة تطبيقية من خلال برنامج معامل افتراضية تفاعلي للتحكم الأتوماتيكي وتشغيل وإدارة كافة أجزاء وحدة الفرملة الهيدروليكية لمحطة محركات ديزل بالدورة رباعية-المشوار وتتضمن عدد ستة سلندرات على نفس عامود الإدارة وتستخدم نظام شحن الهواء التوربيني **air turbo-charger** للاستفادة من غازات العادم ونظام تبريد مائي للسلندرات ولزيت المحرك

What do we have in the Industrial Diesel Engine Brake Unit ?

Contents: Interactive Automatic Control System for an Industrial 6-cylinder, turbo-charger, Diesel engine with a hydraulic brake unit: 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 Industrial 6-cylinder, turbo-charger, and 4-stroke Diesel engine drive. The engine follows the actual indicated compression ignition Diesel Cycle diagram. The thermal balance of this mechanical Power system is also performed and presented for each working engine condition. This extension lab investigates all performance characteristics of the internal combustion engine of VirtLab-8 as a system with two degrees of freedom: during normal operation its output work is altered in two ways: (1) by changing its rpm for a **fixed load** on the engine shaft; (2) by changing position of hand-lever or accelerator to keep same rpm for variable load on the engine shaft. The engine characteristics are obtained at full torque load, power and fuel specific consumption. The engine is mounted on a bench and connected to a dynamometrical brake. All proper operation conditions are adjusted through the control boards. 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.



Air density 1,165 kg/m³
 Fuel density 840 kg/m³
 Heat value 42700 kJ/kg
 Exhaust mean spec. heat 1,046

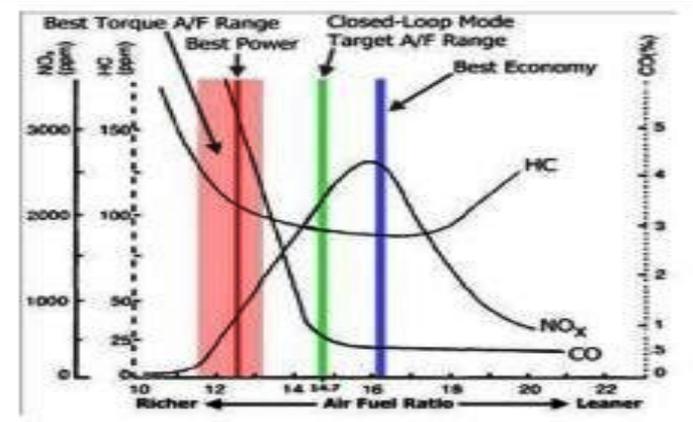
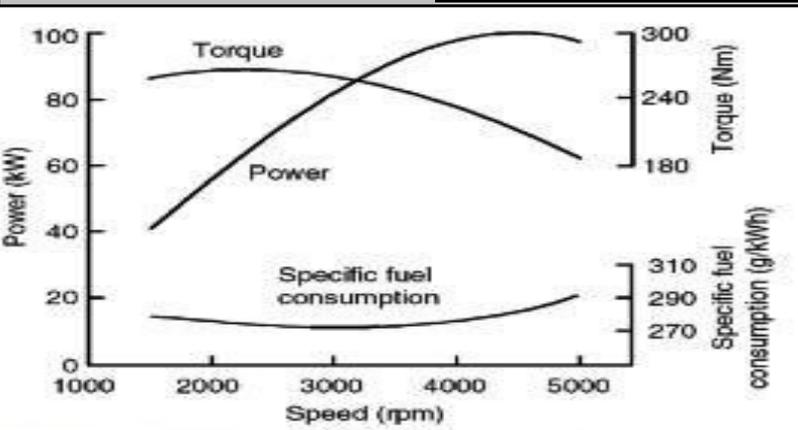
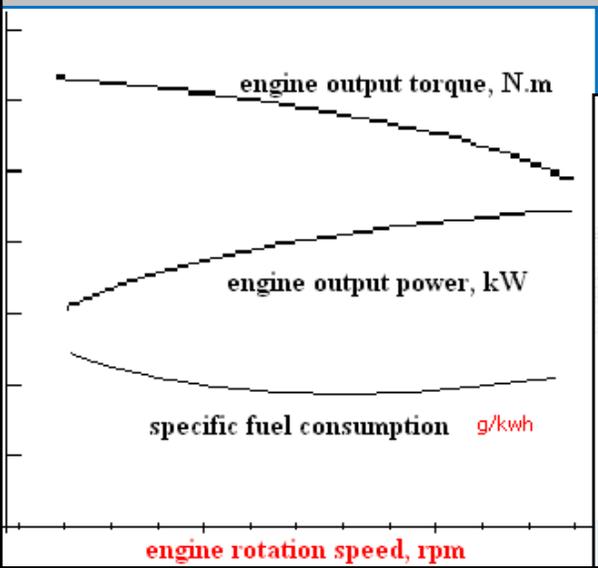


Fig.1 - Torque, Power, BSFC relationship and BSFC Emissions relationship

Course Specifications & Basic Information

1. Title:	Using Virtual Lab Applications for Control of Industrial Diesel Engine Brake Unit			Code:MEP573
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 Industrial 6-cylinder, turbo-charger, and 4-stroke Diesel engine drive. The engine follows the actual indicated compression ignition Diesel Cycle diagram. The thermal balance of this mechanical Power system is also performed and presented for each working engine condition. This extension lab investigates all performance characteristics of the internal combustion engine of VirtLab-8 as a system with two degrees of freedom: during normal operation its output work is altered in two ways: (1) by changing its rpm for a fixed load on the engine shaft; (2) by changing position of hand-lever or accelerator to keep same rpm for variable load on the engine shaft. The engine characteristics are obtained at full torque load, power and fuel specific consumption. The engine is mounted on a bench and connected to a dynamometrical brake. All proper operation conditions are adjusted through the control boards. 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 Diesel Engine Brake Unit.
 - Moral, legal essentials and quality control principals related to the graduate's professional practices in the automatic control fields.
 - Various effects of engineering professional practices of Industrial Diesel Engine Brake Unit on different components of the environment.
 - Methods used for emission/pollution control and energy rationalization and maximization of the benefits of Industrial Diesel Engine Brake.

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 Diesel Engine Brake Unit .
- Analyze & propose professional, technical solutions and algorithms for automatic control problems.
- Analytical reading of research & report topics related to control of Industrial Diesel Engine Brake Unit.
- Evaluate and estimate various risks involved in professional practices related to of Industrial Diesel Engine Brake Unit.
- 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 Diesel Engine Brake unit.

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 Diesel Engine Brake Unit.

Write technical requirements & selecting engineering reference standards for Industrial Diesel Engine Brake Unit.

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.