

MEP 599 Diploma Design Project-Summer Term 2016/2017 – September 2017

## Applications of Virtual Labs for Industrial Diesel Engine Using Thermal Calculations & Hydraulic Brake Unit

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<u>Abstract</u>: 1<sup>st</sup> part of project is an interactive investigation, virtual PC simulation & flow visualization of important concepts of practical automatic control & real thermo-fluid processes in Industrial 6-cylinder, turbocharger, 4-stroke Diesel engine drive. Engine follows actual indicated compression ignition Cycle. Thermal balance of Power system is performed for various working conditions. Engine utilizes exhaust gases to drive a compressor turbo-charger to increase fresh air into the cycle. This unit has air-cooler &2 sea water pumps. 6-cylinders are jacket-water cooled by fresh water & 2-water pumps. Fuel is pumped using 2-fuel pumps. Lube oil is driven by 2 pumps &lube oil cooler through one of the 2 sea-water heat exchangers. 2<sup>nd</sup> sea-water exchanger cools fresh water in cooling circuit. Auto-control system includes both the engine conductions section & auxiliary management section. Simulation includes various critical control alarms, I/O signals, operation & instrumentation parameter-boards, diagnostic page tools, error-report filling, help/trouble-shooting menus, Thermal Balance Calculations &Plotting tools.





The 2<sup>nd</sup> Part of this project investigates all performance characteristics of the same internal combustion Diesel Engine of Part-1 but as a system with 2 degrees of freedom: during normal operation its output work is altered in 2 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 the proper operation conditions are adjusted through control boards. The run simulation includes many critical control alarms, I/O signals, operation and instrumentation parameter-boards, diagnostic page tools, error report filling, help/trouble-shooting menus and Thermal Balance Calculations and Plotting tools.



## Why does an engine need a test?

-Historically, test basically is to find out power& fuel consumption, also to test effectiveness of cooling, vibration and noise, lubrication, controllability, etc.
- Modern regulations force engines to reduce harmful emission and comply stringent regulations, therefore, test is getting more and more sophisticated.





