



## LABORATORY PLANNING GUIDE

# L38 Driving and Driven Machines Laboratory

Content

Covered subjects according to the curriculum.....	2
Main concept.....	2
Initial training provided for laboratory personnel .....	3
Requirements / Utilities .....	3
Schedule of requirements .....	4



### Covered subjects according to the curriculum

Major topics of learning content:

- familiarisation with the function and typical behaviour of a gas turbine
  - \* operation as jet engine
  - \* operation as power turbine
  - \* determining the system efficiency
- familiarisation with the function and typical behaviour of a two-cylinder piston steam engine
  - \* calculating the overall efficiency
  - \* determining the heat dissipated in the condenser
  - \* recording the vapour pressure curve
  - \* effective output
  - \* specific steam consumption by the steam engine
  - \* thermal capacity of the boiler
  - \* energy gradient across the steam engine
- design and function of a two-stage compressor
  - \* measurement of relevant pressures and temperatures
  - \* determination of the intake air flow rate
  - \* compression process on a p-V diagram
  - \* determination of the efficiency
- steam power plant and its components
  - \* start-up, operation and shut down
  - \* closed steam-water circuit with feedwater treatment
  - \* boiler efficiency
  - \* mechanical/thermal efficiency of the turbine
  - \* condenser efficiency
  - \* specific fuel consumption of the plant
- energy balance of a cooling tower
- behaviour during operation of a jet engine including start-up procedure
  - \* determination of the specific thrust
  - \* determination of the specific fuel consumption
  - \* determination of lambda (fuel-air ratio)

### Main concept

The laboratory is designed for accommodation of 24 students + 2 laboratory staff:

- 2 - 4 students form a team and work together at a workstation / training system
- 5 different workstations
- All workstations are floor standing
- All workstations are equipped with a PC
- Each workstation is equipped with a manual containing technical information, basic theory, experiment instructions, evaluation help and safety advice.
- Student teams are scheduled to change workstations from lab session to lab session in order to perform the entire range of experiments within the course duration.
- Average time per experiment: 90 to 120 minutes.

2 workstations for laboratory staff (with PC and internet access)

1 printer for common use

1 cupboard for small parts, consumables, tools, paper etc.

### Initial training provided for laboratory personnel

Trainer: Specialized engineer of G.U.N.T. Gerätebau GmbH, Germany.

To be conducted immediately after installation and commissioning of the equipment.

General topics to be covered for any of the educational systems:

- Basic familiarization with the system.
- Functions and components.
- Overall system configuration aspects.
- Start-up and operational aspects.
- Conduction experiments, including evaluation and calculation.
- Using the system with and without the software (where applicable).
- Trouble shooting and maintenance aspects.
- Hands-on, practical familiarization aspects.
- Seminar participants with the delivered system.
- Details of the manuals.
- Safe operation and preventive maintenance.

### Requirements / Utilities

Power supply:

- 230 V / 50 Hz / 1 phase – at least 15 power sockets
- 400 V / 50 Hz / 3 phases up to 63A – at least 6 power sockets

Water:

- 5 x cold water
- 5 x Drain

Others:

- Fresh air
- Exit air
- Propane gas
- Compressed air

Laboratory computer network:

- 2 internet connections for staff
- 5 internet connections for students

Location:

- Laboratory space min 84 m<sup>2</sup>
- This laboratory should be installed on the ground floor

Schedule of requirements

Item No.	Description	Quantity
Item 1	Gas turbine	1 pcs.
Item 2	Two-cylinder steam engine	1 pcs.
Item 2.1	Universal drive and brake unit	1 pcs.
Item 2.2	Electrical steam generator	1 pcs.
Item 3	Two-stage piston compressor	1 pcs.
Item 4	Steam power plant, 1,5kW	1 pcs.
Item 4.1	Cooling tower 115kW	1 pcs.
Item 5	Gas turbine jet engine	1 pcs.