LABORATORY PLANNING GUIDE

L38 Driving and Driven Machines Laboratory

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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**


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 m²
- This laboratory should be installed on the ground floor
### Schedule of requirements

<table>
<thead>
<tr>
<th>Item No.</th>
<th>Description</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Item 1</td>
<td>Gas turbine</td>
<td>1 pcs.</td>
</tr>
<tr>
<td>Item 2</td>
<td>Two-cylinder steam engine</td>
<td>1 pcs.</td>
</tr>
<tr>
<td>Item 2.1</td>
<td>Universal drive and brake unit</td>
<td>1 pcs.</td>
</tr>
<tr>
<td>Item 2.2</td>
<td>Electrical steam generator</td>
<td>1 pcs.</td>
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<tr>
<td>Item 3</td>
<td>Two-stage piston compressor</td>
<td>1 pcs.</td>
</tr>
<tr>
<td>Item 4</td>
<td>Steam power plant, 1.5kW</td>
<td>1 pcs.</td>
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<tr>
<td>Item 4.1</td>
<td>Cooling tower 115kW</td>
<td>1 pcs.</td>
</tr>
<tr>
<td>Item 5</td>
<td>Gas turbine jet engine</td>
<td>1 pcs.</td>
</tr>
</tbody>
</table>