LABORATORY PLANNING GUIDE

L12 Properties of Materials Laboratory

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Covered subjects according to the curriculum

Major topics of learning content:
- Tensile tests
- Recording of stress-strain diagrams
- Brinell hardness testing
- Compressive strength tests
- Bending tests
- Cupping tests
- Shear tests
- Testing of disc and helical springs
- Determination of notched bar impact work
- Determination of notched bar impact strength
- Evaluation of fracture surface characteristics
- Notched bar impact work-temperature curve
- Influence of notch shape on the notched bar impact work
- Influence of materials and their prior heat treatment on the notched bar impact work
- Influence of specimen temperature on the notched bar impact work
- Torsion tester for metallic test bars, loading to destruction of the specimens
- Effect of specimen material, specimen cross-section and specimen length
- Creep experiment with a lead specimen
- Creep experiment with a plastic probe
- Fatigue strength of bars subject to cyclic bending load
- Influence of different curvature radii and surface
- Finish on fatigue strength
- Stress-number (S-N) curve

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
- 18 workstations with 26 different experiment units
- 12 laboratory tables and storage space required for alternating use
- 12 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 30 power sockets distributed according to lab lay-out
Laboratory computer network:
  • 2 internet connections for staff
  • 12 internet connections for students
Location:
  • Laboratory space min 72 m²
  • This laboratory could be installed on any floor (e.g. ground floor or 1st 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>Material testing, 20kN</td>
<td>6 pcs.</td>
</tr>
<tr>
<td>Item 1.1</td>
<td>Data acquisition system</td>
<td>6 pcs.</td>
</tr>
<tr>
<td>Item 1.2</td>
<td>Set of 4 tension test rods: aluminum, copper, steel, brass</td>
<td>30 pcs.</td>
</tr>
<tr>
<td>Item 1.3</td>
<td>Bending device</td>
<td>2 pcs.</td>
</tr>
<tr>
<td>Item 1.4</td>
<td>Compression plates, set of 2, with fastening elements</td>
<td>2 pcs.</td>
</tr>
<tr>
<td>Item 1.5</td>
<td>Coil spring test, 2 sets</td>
<td>2 pcs.</td>
</tr>
<tr>
<td>Item 1.6</td>
<td>Disk spring test</td>
<td>2 pcs.</td>
</tr>
<tr>
<td>Item 1.7</td>
<td>Device for shearing experiments</td>
<td>2 pcs.</td>
</tr>
<tr>
<td>Item 1.8</td>
<td>Device for cupping experiments</td>
<td>2 pcs.</td>
</tr>
<tr>
<td>Item 1.9</td>
<td>Measuring magnifier for Brinell impression</td>
<td>2 pcs.</td>
</tr>
<tr>
<td>Item 2</td>
<td>Impact test, 25Nm</td>
<td>3 pcs.</td>
</tr>
<tr>
<td>Item 2.1</td>
<td>System for data acquisition</td>
<td>3 pcs.</td>
</tr>
<tr>
<td>Item 2.2</td>
<td>Safety cage for impact tester</td>
<td>3 pcs.</td>
</tr>
<tr>
<td>Item 2.3</td>
<td>Set of 10 ISO-V specimens, free cutting steel, 5mm</td>
<td>3 pcs.</td>
</tr>
<tr>
<td>Item 2.4</td>
<td>Set of 10 ISO-V specimens, brass, 5mm</td>
<td>3 pcs.</td>
</tr>
<tr>
<td>Item 2.5</td>
<td>Set of 10 ISO-V specimens, brass, 10mm</td>
<td>3 pcs.</td>
</tr>
<tr>
<td>Item 2.6</td>
<td>Set of 10 ISO-U specimens, free cutting steel, 5mm</td>
<td>3 pcs.</td>
</tr>
<tr>
<td>Item 3</td>
<td>Torsion test, 30Nm</td>
<td>3 pcs.</td>
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<tr>
<td>Item 3.1</td>
<td>Torsiometer</td>
<td>3 pcs.</td>
</tr>
<tr>
<td>Item 3.2</td>
<td>Set of 6 torsion specimens</td>
<td>3 pcs.</td>
</tr>
<tr>
<td>Item 4</td>
<td>Creep rupture test</td>
<td>3 pcs.</td>
</tr>
<tr>
<td>Item 4.1</td>
<td>Set of 10 test specimens, PE</td>
<td>3 pcs.</td>
</tr>
<tr>
<td>Item 4.2</td>
<td>Set of 10 test specimens, Pb</td>
<td>3 pcs.</td>
</tr>
<tr>
<td>Item 5</td>
<td>Fatigue strength test</td>
<td>3 pcs.</td>
</tr>
<tr>
<td>Item 5.1</td>
<td>Data acquisition system</td>
<td>3 pcs.</td>
</tr>
<tr>
<td>Item 5.2</td>
<td>Set of 3 specimens steel</td>
<td>10 pcs.</td>
</tr>
</tbody>
</table>
Laboratory drawing