



## LABORATORY PLANNING GUIDE

# L15 Dynamics & Vibration Laboratory

Content

Covered subjects according to the curriculum..... 2

Main concept..... 3

Initial training provided for laboratory personnel ..... 3

Requirements / Utilities ..... 3

Schedule of requirements ..... 4

Laboratory drawing ..... 5



Covered subjects according to the curriculum

Major topics of learning content:

- Spur gear train with intermediate gear
- Two-stage spur gear train
- Planet gear train
- Equilibrium of moments
- Equilibrium of forces
- Relationship between force reduction and cord travel
- Kinetics and kinematics of the following centrifugal systems
  - \* Porter governor
  - \* Proell governor
  - \* Hartnell governor
- Determination of the moment of inertia of various bodies
- Influence of the rotating mass on the moment of inertia
- Influence of the radius of rotation on the moment of inertia
- Demonstration of the law of gravity on an inclined plane
- Influence of the mass of a body on its acceleration
- Experimental determination of the mass moment of inertia of a metal flywheel
- Experiments with pendulums
  - \* reversing pendulum
  - \* shortened pendulum length
  - \* spring-mass system
- Damped, undamped and forced vibration
- Damped and undamped resonance
- Multi-weight oscillator absorption effect
- Natural frequency of torsional vibration
- Effect of torsional stiffness, rotating mass and damping
- Explanation and determination of unbalance
- Investigation of static, dynamic and basic unbalance
- Balancing process
- Effect of mass forces in dependence on the speed and in dependence on the piston mass
- First and second order mass forces
- Comparison of different crank drives at reciprocating engines
- Bending vibrations and resonance of a rotating shaft
- Critical speeds with different arrangements of the bearing and masses on the rotor shaft
- Investigation of the rotor shaft's self-centring effect
- Dynamic behaviour of multistage planetary gears

### 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
- 13 different workstations
- Each experiment unit on its own table to allow short prepare times
- 4 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 distributed according to lab lay-out

Laboratory computer network:

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

Location:

- Laboratory space min 72 m<sup>2</sup>
- This laboratory could be installed on any floor (e.g. ground floor or 1<sup>st</sup> floor)

Schedule of requirements

Item No.	Description	Quantity
Item 1	Kinematic model: gear drive	1 pcs.
Item 2	Equilibrium of moments on pulleys	1 pcs.
Item 3	Equilibrium of moments on a differential pulley block	1 pcs.
Item 4	Spur gear unit	1 pcs.
Item 5	Worm gear unit	1 pcs.
Item 6	Cable winch	1 pcs.
Item 7	Centrifugal force	1 pcs.
Item 8	Coriolis force	1 pcs.
Item 9	Gyroscope	1 pcs.
Item 10	Centrifugal governor	1 pcs.
Item 11	Rotational inertia	1 pcs.
Item 12	Rolling disc on inclined plane	1 pcs.
Item 13	Kinetic model: flywheel	1 pcs.
Item 14	Vibration trainer	1 pcs.
Item 14.1	Free and damped torsional vibrations	1 pcs.
Item 14.2	System for data acquisition	1 pcs.
Item 15	Rotational vibrations	1 pcs.
Item 16	Balancing apparatus	1 pcs.
Item 17	Forces at reciprocating engines	1 pcs.
Item 18	Bending elasticity in rotors	1 pcs.
Item 18.1	System for data acquisition	1 pcs.
Item 19	Elastic shafts	1 pcs.
Item 19.1	System for data acquisition	1 pcs.
Item 20	Dynamic behaviour of multistage planetary gears	1 pcs.
Item 21	Dynamic behaviour of multistage spur gears	1 pcs.
Item 22	Investigation of cam mechanisms	1 pcs.
Item 23	Pressure distribution in journal bearings	1 pcs.
Item 24	Drive unit for tribological investigations	1 pcs.
Item 24.1	Rolling friction in friction wheels	1 pcs.
Item 24.2	Elasto-hydrodynamic behaviour	1 pcs.
Item 24.3	Dynamic friction in pin - disk	1 pcs.
Item 24.4	Frictional vibrations	1 pcs.
Item 24.5	Dynamic friction in cylindrical pin - roller	1 pcs.
Item 24.6	Pressure distribution in journal bearings	1 pcs.

Laboratory drawing

