WELCOME

The publishers of this Aviation Maintenance Technician Certification Series welcome you to the world of aviation maintenance. As you move towards EASA certification, you are required to gain suitable knowledge and experience in your chosen area. Qualification on basic subjects for each aircraft maintenance license category or subcategory is accomplished in accordance with the following matrix. Where applicable, subjects are indicated by an "X" in the column below the license heading.

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We wish you good luck and success in your studies and in your aviation career!

REVISION LOG

VERSION	EFFECTIVE DATE	DESCRIPTION OF CHANGE
001	2018 12	Module Creation and Release
002	2020 05	Clarified formulas for Buoyant Force (page 2.7) and Vibration (page 2.11)
002.1	2021 05	Corrected formulas for Pendular Movement and Vibration. Sub-Module 02, page 2.11 and page 2.12

MODULE EDITIONS AND UPDATES

ATB EASA Modules are in a constant state of review for quality, regulatory updates, and new technologies. This book's edition is given in the revision log above. Update notices will be available Online at *www.actechbooks.com/revisions.html*
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frequency is shared by vibrating objects and a pendulum. So the formula for vibration remains the same as for a pendulum, or a mass hanging on a string.

$$T = 2\pi\sqrt{\frac{M}{k}}$$

Where:

T = period in seconds (s)
M = mass in pounds or kilograms (kg)
k = force in pound/feet or Newton/meters (N/m)

HARMONICS

When an object is forced to vibrate at its natural frequencies, it vibrates in a manner such that a standing wave pattern is formed within the object. Whether it is a guitar string, or an air column, the medium vibrates in such a way that a standing wave pattern results.

Each natural frequency that an object or musical instrument produces has its own characteristic vibration pattern. These patterns are created at specific frequencies, which are known as harmonics. For objects that vibrate in regular and periodic fashion, the harmonic frequencies are related to each other by simple whole number ratios. (***Figure 2-13***)

RESONANCE

All types of matter, regardless of whether it is a solid, liquid, or gas, have a natural frequency at which the atoms within that matter vibrate. If two pieces of matter have the same natural frequency, and one of them starts to vibrate, it can transfer its wave energy to the other one and cause it to vibrate. This transfer of energy is known as resonance. Some piston engine powered airplanes have an rpm range that they are placarded to avoid because spinning the prop at that rpm can cause vibration problems. The difficulty lies in the natural frequency of the metal in the prop, and the frequency of vibration that will be set up with a particular tip speed for the prop. At that particular rpm, stresses can be set up that could lead to the propeller coming apart.

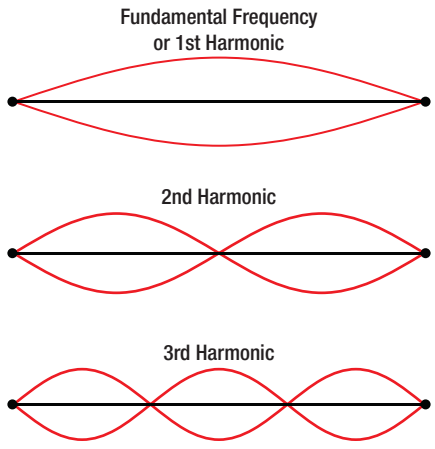

Figure 2-13. The first three levels of harmonic vibration.

VELOCITY RATIO, MECHANICAL ADVANTAGE AND EFFICIENCY

VELOCITY RATIO

Velocity ratio is the ratio of the distance travelled by the effort, compared to the distance travelled by the load in a simple machine. Friction is not included in the computation. As shown in ***Figure 2-14***, because of the lever distance between the handle and the wheels, the worker has pulled the handles up a distance of 300 mm, causing the wheelbarrow's supporting legs to rise by a distance of 100 mm. Thus, the velocity ratio is measured at 3:1. Similarly, an effort exerted of 100 Newtons for a distance of 300 mm equals a result of 300 Newtons moved a distance of 100 mm.

SIMPLE MACHINE

A machine is any device with which work may be accomplished. In application, machines can be used for any of the following purposes, or combinations of these purposes.

1. Machines are used to transform energy, as in the case of a generator transforming mechanical energy into electrical energy.
2. Machines are used to transfer energy from one place to another, as in the examples of the connecting rods, crankshaft, and reduction gears transferring energy from an aircraft's engine to its propeller.
3. Machines are used to multiply force; for example, a system of pulleys may be used to lift a heavy load. The pulley system enables the load to be raised by exerting a force that is smaller than the weight of the load.
4. Machines can be used to multiply speed. A good example is the bicycle, by which speed can be gained by exerting a greater force.
5. Machines can be used to change the direction of a force. An example of this use is the flag hoist. A downward force on one side of the rope exerts an upward force on the other side, raising the flag toward the top of the pole.