Biomechanics and Allied Fields

Kinesiology
-anthropometry
-physiology
-psychomotor

Health sciences
-ergonomics
-occupational and
-physical therapy

Natural sciences
-biophysics
-physics
-zoology

Biomechanics

Engineering
-biomedical
-electrical
-mechanical

Mathematics
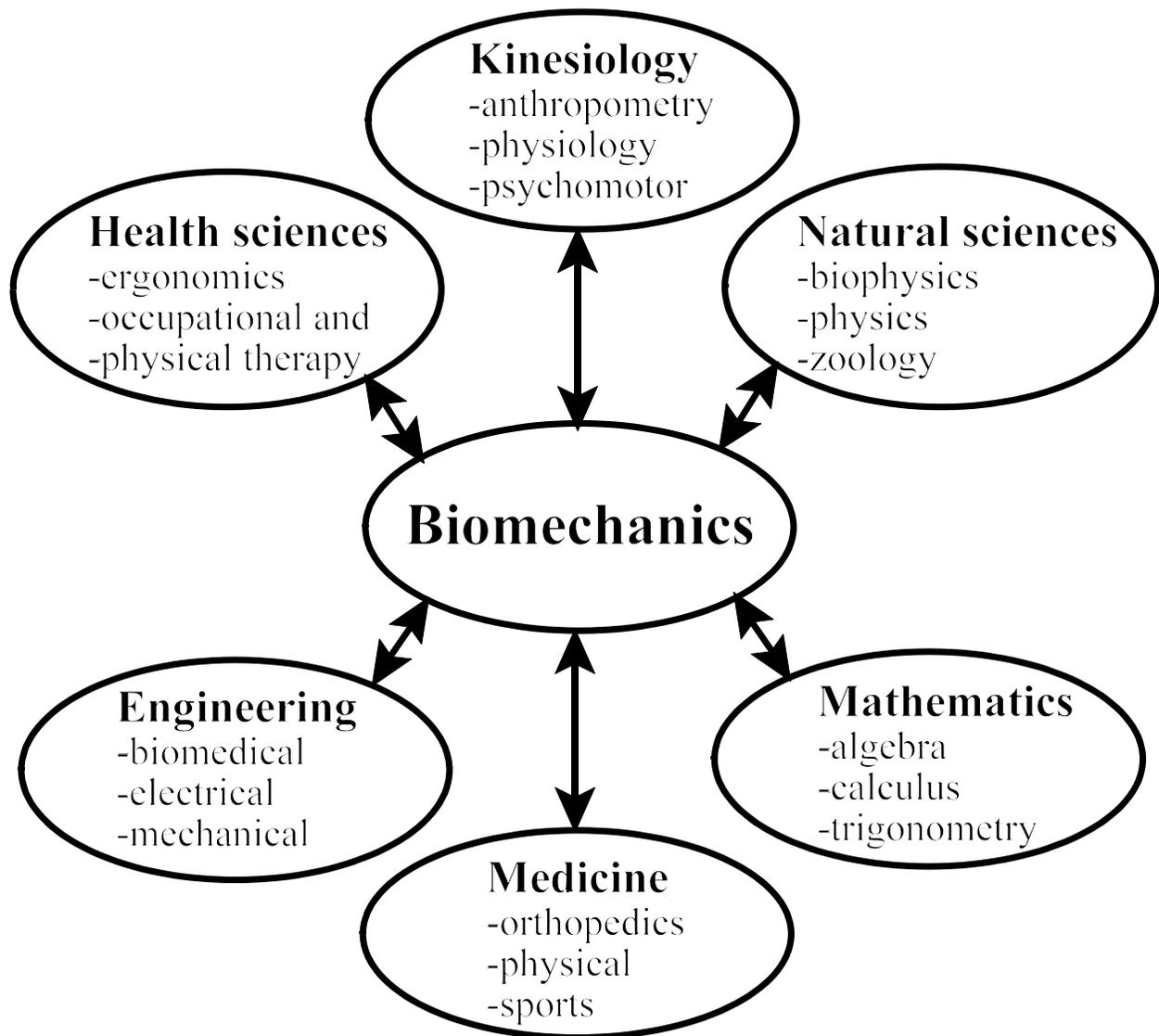-algebra
-calculus
-trigonometry

Medicine
-orthopedics
-physical
-sports

Definitions

Mechanics: science that describes and predicts the conditions of <u>rest or motion of bodies</u> under the action of forces and moments of force

Biomechanics: science which describes and predicts the conditions of rest or motion of <u>biological systems</u> under the action of forces and moments of force

Rigid body: body that cannot be <u>deformed, stretched or compressed</u>. A body whose particles have fixed positions with respect to each other.

Statics: branch of mechanics concerned with bodies <u>at rest or in constant linear motion</u>

Dynamics: branch of mechanics concerned with <u>bodies in motion</u>

Kinematics: branch of dynamics that <u>describes the state of motion of bodies</u>, for example, their linear and angular displacements, velocities and accelerations without regard to the causes of the motion
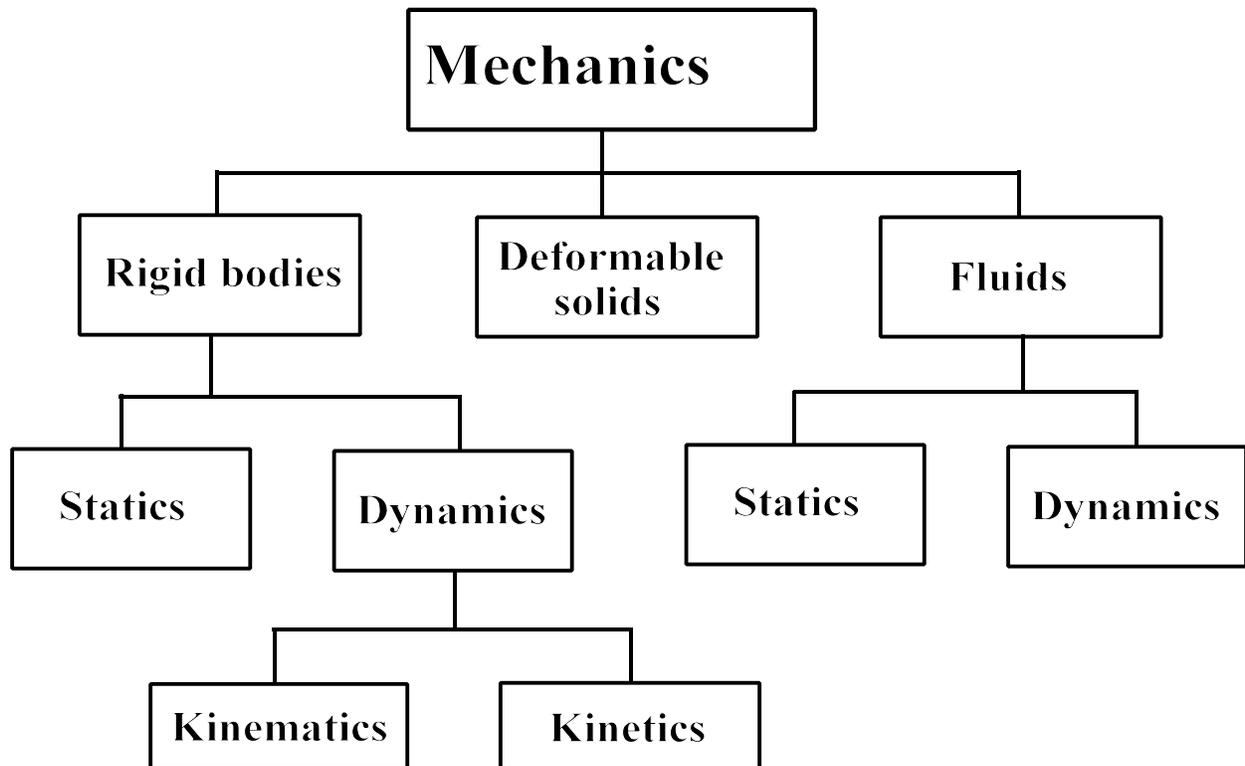
Kinetics: branch of dynamics concerned with the <u>causes of motion and the action of forces</u>, including the work, impulse and power of forces and moments of force

Direct dynamics: method for <u>computing the kinematics of a body</u> based on the forces and moments of force applied to the body. Usually, this method is considered an engineering field.

Inverse dynamics: method for <u>computing forces and/or moments of force</u> based on the kinematics of a body and the body's <u>inertial properties</u>. This method is mostly associated with the field of biomechanics.

Inertial properties: mass and mass distribution of bodies, including the location of the mass centres and moments of inertia

Subdivisions of Mechanics

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                        ┌─────────────────┐
                        │    Mechanics    │
                        └────────┬────────┘
         ┌───────────────────────┼───────────────────────┐
┌────────────────┐      ┌────────────────┐      ┌────────────────┐
│  Rigid bodies  │      │   Deformable   │      │     Fluids     │
│                │      │     solids     │      │                │
└────────┬───────┘      └────────────────┘      └────────┬───────┘
    ┌─────┴──────┐                                   ┌─────┴──────┐
┌─────────┐ ┌──────────┐                       ┌─────────┐ ┌──────────┐
│ Statics │ │ Dynamics │                       │ Statics │ │ Dynamics │
└─────────┘ └─────┬────┘                       └─────────┘ └──────────┘
           ┌───────┴────────┐
     ┌────────────┐  ┌────────────┐
     │ Kinematics │  │  Kinetics  │
     └────────────┘  └────────────┘
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Conversion of Units

Example: Convert speed of 22.0 metres per second (m/s) to the equivalent speed in miles per hour (mph).

Step 1 Write out the number and its units using a horizontal format for the denominational part. E.g.,

$$22.0 \ m/s \quad \text{becomes} \quad 22.0 \frac{m}{s}$$

Step 2 Multiply the expression by the ratio of the units you are converting from to the units you are converting to. I.e.,

$$22.0 \frac{m}{s} \times \frac{1 \ mile}{1609 \ m}$$

Step 3 Cancel units where appropriate and reduce the numerical parts.

$$22.0 \frac{m}{s} \times \frac{1 \ mile}{1609 \ m} = 0.01367 \frac{miles}{s}$$

Step 4 Repeat steps 2 and 3 if other units need to be converted. I.e.,

$$0.01367 \frac{miles}{s} \times \frac{3600 \ s}{1 \ h} = 49.2 \ mph$$

Numerical Accuracy

To achieve an accuracy of 0.2%, round numbers to three significant figures unless the first significant figure is a one (1), then use four significant figures.

Examples:

25.333 becomes 25.3

1.4526 becomes 1.453

3452.067 becomes 3450

0.004 568 becomes 0.004 57

1.3333 becomes 1.333

7605.25 becomes 7610