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Gear Trains Formulas

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List of 13 Gear Trains Formulas

Gear Trains

1) Braking or Holding Torque on Fixed Member given Input Torque

Open Calculator

fx $$T = T_1 \cdot \left(\frac{\omega_1}{\omega_2} - 1 \right)$$

ex $$-2.833333\text{N*m} = 17\text{N*m} \cdot \left(\frac{10\text{rad/s}}{12\text{rad/s}} - 1 \right)$$

2) Holding or Braking or Fixing Torque on Fixed Member

Open Calculator

fx $$T = T_1 \cdot \left(\frac{N_1}{N_2} - 1 \right)$$

ex $$196.6283\text{N*m} = 17\text{N*m} \cdot \left(\frac{1400\text{rev/min}}{700\text{rev/min}} - 1 \right)$$

3) Holding or Braking or Fixing Torque on Fixed Member given Input and Output Torque

Open Calculator

fx $$T = -(T_1 + T_2)$$

ex $$-35\text{N*m} = -(17\text{N*m} + 18\text{N*m})$$

4) Output Torque on Driven Member given Angular Speed of Driven and Driver

Open Calculator

fx $$T_2 = T_1 \cdot \frac{N_1}{N_2}$$

ex $$213.6283\text{N*m} = 17\text{N*m} \cdot \frac{1400\text{rev/min}}{700\text{rev/min}}$$

5) Output Torque or Resisting or Load Torque on Driven Member

Open Calculator

fx $$T_2 = -T_1 \cdot \frac{\omega_1}{\omega_2}$$

ex $$-14.166667\text{N*m} = -17\text{N*m} \cdot \frac{10\text{rad/s}}{12\text{rad/s}}$$

6) Speed Ratio of Compound Gear Train

Open Calculator

fx $$i = \frac{P_{driven}}{P_{driver}}$$

ex $$0.592593 = \frac{16}{27}$$

7) Train Value given Number of Teeth

Open Calculator

fx $$T_v = \frac{T_{driver}}{T_{driven}}$$

ex $$1.333333 = \frac{20}{15}$$

8) Train Value given Speed of Follower and Driver

Open Calculator

fx $$T_v = \frac{N_f}{N_d}$$

ex $$0.8125 = \frac{26\text{rev/min}}{32\text{rev/min}}$$

9) Train Value of Compound Gear Train given product of Teeth on Driven and Driver Gear

Open Calculator

fx $$T_v = \frac{P_{driver}}{P_{driven}}$$

ex $$1.6875 = \frac{27}{16}$$

10) Train Value of Compound Gear Train given Speed of Driven and Driver Gear

Open Calculator

fx $$T_v = \frac{N_n}{N_{d1}}$$

ex $$0.785714 = \frac{22\text{rev/min}}{28\text{rev/min}}$$

11) Velocity Ratio

Open Calculator

fx $$i = \frac{T_{driven}}{T_{driver}}$$

ex $$0.75 = \frac{15}{20}$$

12) Velocity Ratio of Compound Belt Drive

Open Calculator

fx $$i = \frac{N_n}{N_{d1}}$$

ex $$0.785714 = \frac{22\text{rev/min}}{28\text{rev/min}}$$

13) Velocity Ratio of Compound Belt Drive given Product of Diameter of Driven

Open Calculator

fx $$i = \frac{P_1}{P_2}$$

ex $$0.666667 = \frac{40}{60}$$

Variables Used

- **i** Velocity Ratio
- N_1 Angular Speed of Driving Member in RPM *(Revolution per Minute)*
- N_2 Angular Speed of Driven Member in RPM *(Revolution per Minute)*
- N_d Speed of Driver *(Revolution per Minute)*
- N_{d1} Speed of First Driver *(Revolution per Minute)*
- N_f Speed of Follower *(Revolution per Minute)*
- N_n Speed of Last Driven Pulley *(Revolution per Minute)*
- P_1 Product of Diameters of Drivers
- P_2 Product of Diameters of Drivens
- P_{driven} Product of Number of Teeth on Driven
- P_{driver} Product of Number of Teeth on Drivers
- **T** Total Torque *(Newton Meter)*
- T_1 Input Torque on Driving Member *(Newton Meter)*
- T_2 Output Torque or Load Torque on Driven Member *(Newton Meter)*
- T_{driven} No. of Teeth on Driven
- T_{driver} No. of Teeth on Driver
- T_v Train Value
- ω_1 Angular Speed of Driving Member *(Radian per Second)*
- ω_2 Angular Speed of Driven member *(Radian per Second)*

Constants, Functions, Measurements used

- Measurement: **Frequency** in Revolution per Minute (rev/min)
  Frequency Unit Conversion
- Measurement: **Angular Velocity** in Radian per Second (rad/s), Revolution per Minute (rev/min)
  Angular Velocity Unit Conversion
- Measurement: **Torque** in Newton Meter (N*m)
  Torque Unit Conversion

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