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Dynamometer Formulas

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List of 19 Dynamometer Formulas

Dynamometer

1) Constant for Particular Shaft for Torsion Dynamometer

Open Calculator

fx $$k = \frac{G \cdot J}{L_{shaft}}$$

ex $$1095.238 = \frac{40 N/m^2 \cdot 11.5 m^4}{0.42 m}$$

2) Distance Moved in One Revolution by Rope Brake Dynamometer

Open Calculator

fx $$d = \pi \cdot (D_{wheel} + d_{rope})$$

ex $$5.340708 m = \pi \cdot (1.6 m + 0.1 m)$$

3) Load on Brake for Rope Brake Dynamometer

Open Calculator

fx $$W = W_{dead} - S$$

ex $$7 N = 9 N - 2 N$$

4) Tangential Effort for Epicyclic-Train Dynamometer

Open Calculator

fx $$P_t = \frac{W_{end} \cdot L_{horizontal}}{2 \cdot a_{gear}}$$

ex $$10.59615N = \frac{19N \cdot 1.45m}{2 \cdot 1.3m}$$

5) Tension in Slack Side of Belt for Belt Transmission Dynamometer

Open Calculator

fx $$T_2 = T_1 - \frac{W_{end} \cdot L_{horizontal}}{2 \cdot a_{pulley}}$$

ex $$6.694444N = 22N - \frac{19N \cdot 1.45m}{2 \cdot 0.9m}$$

6) Tension in Tight Side of Belt for Belt Transmission Dynamometer

Open Calculator

fx $$T_1 = T_2 + \frac{W_{end} \cdot L_{horizontal}}{2 \cdot a_{pulley}}$$

ex $$26.30556N = 11N + \frac{19N \cdot 1.45m}{2 \cdot 0.9m}$$

7) Torsion Equation for Torsion Dynamometer

Open Calculator

fx $$T = k \cdot \theta$$

ex $$17.04N*m = 12 \cdot 1.42rad$$

8) Torsion Equation for Torsion Dynamometer using Modulus of Rigidity

Open Calculator

fx $$T = \frac{G \cdot \theta \cdot J}{L_{shaft}}$$

ex $$1555.238\text{N*m} = \frac{40\text{N/m}^2 \cdot 1.42\text{rad} \cdot 11.5\text{m}^4}{0.42\text{m}}$$

Polar Moment of Inertia

9) Polar Moment of Inertia of Shaft for Hollow Shaft for Torsion Dynamometer

Open Calculator

fx $$J = \frac{\pi}{32} \cdot \left(d_o^4 - d_i^4\right)$$

ex $$0.035619\text{m}^4 = \frac{\pi}{32} \cdot \left((0.81\text{m})^4 - (0.51\text{m})^4\right)$$

10) Polar Moment of Inertia of Shaft for Solid Shaft for Torsion Dynamometer

Open Calculator

fx $$J = \frac{\pi}{32} \cdot D_{shaft}^4$$

ex $$0.006136\text{m}^4 = \frac{\pi}{32} \cdot (0.5\text{m})^4$$

11) Polar Moment of Inertia of Shaft for Torsion Dynamometer

Open Calculator

fx $$J = \frac{T \cdot L_{shaft}}{G \cdot \theta}$$

ex $$0.096127\text{m}^4 = \frac{13\text{N*m} \cdot 0.42\text{m}}{40\text{N/m}^2 \cdot 1.42\text{rad}}$$

Power Transmitted

12) Power Transmitted by Torsion Dynamometer

Open Calculator

fx $$P = \frac{2 \cdot \pi \cdot N \cdot T}{60}$$

ex $$680.6784\text{W} = \frac{2 \cdot \pi \cdot 500 \cdot 13\text{N*m}}{60}$$

13) Power Transmitted for Epicyclic-Train Dynamometer

Open Calculator

fx $$P = \frac{2 \cdot \pi \cdot N \cdot T}{60}$$

ex $$680.6784\text{W} = \frac{2 \cdot \pi \cdot 500 \cdot 13\text{N*m}}{60}$$

14) Power Transmitted for Epicyclic-Train Dynamometer using Tangential Effort

Open Calculator

fx $$P = \frac{2 \cdot \pi \cdot N \cdot P_t \cdot r_p}{60}$$

ex $$131.9469\text{W} = \frac{2 \cdot \pi \cdot 500 \cdot 7\text{N} \cdot 0.36\text{m}}{60}$$

Torque Transmitted

15) Torque Acting on Shaft for Torsion Dynamometer

Open Calculator

fx $$T = \frac{G \cdot \theta \cdot J}{L_{shaft}}$$

ex $$1555.238\text{N*m} = \frac{40\text{N/m}^2 \cdot 1.42\text{rad} \cdot 11.5\text{m}^4}{0.42\text{m}}$$

16) Torque on Shaft of Prony Brake Dynamometer

Open Calculator

fx $$T = W_{end} \cdot L_{horizontal}$$

ex $$27.55\text{N*m} = 19\text{N} \cdot 1.45\text{m}$$

17) Torque on Shaft of Prony Brake Dynamometer using Radius of Pulley

Open Calculator

fx $$T = F \cdot R$$

ex $$32\text{N*m} = 8\text{N} \cdot 4\text{m}$$

18) Torque Transmitted for Epicyclic Train Dynamometer

Open Calculator

fx $$T = P_t \cdot r_p$$

ex $$2.52\text{N*m} = 7\text{N} \cdot 0.36\text{m}$$

19) Torque Transmitted if Power is known for Epicyclic-Train Dynamometer

Open Calculator

fx $$T = \frac{60 \cdot P}{2 \cdot \pi \cdot N}$$

ex $$17.18873\text{N*m} = \frac{60 \cdot 900\text{W}}{2 \cdot \pi \cdot 500}$$

Variables Used

- a_{gear} Distance between Center of Gear and Pinion *(Meter)*
- a_{pulley} Distance between Loose Pulleys and T-Frame *(Meter)*
- **d** Distance Moved *(Meter)*
- d_i Shaft Inner Diameter *(Meter)*
- d_o Shaft Outer Diameter *(Meter)*
- d_{rope} Diameter of Rope *(Meter)*
- D_{shaft} Shaft Diameter *(Meter)*
- D_{wheel} Diameter of Wheel *(Meter)*
- **F** Frictional Resistance between Block and Pulley *(Newton)*
- **G** Modulus of Rigidity *(Newton per Square Meter)*
- **J** Polar Moment of Inertia of Shaft *($Meter^4$)*
- **k** Constant for a Particular Shaft
- $L_{horizontal}$ Distance between Weight and Center of Pulley *(Meter)*
- L_{shaft} Shaft Length *(Meter)*
- **N** Speed of Shaft in RPM
- **P** Power *(Watt)*
- P_t Tangential Effort *(Newton)*
- **R** Radius of Pulley *(Meter)*
- r_p Pitch Circle Radius *(Meter)*
- **S** Spring Balance Reading *(Newton)*
- **T** Total Torque *(Newton Meter)*
- T_1 Tension in Tight Side of Belt *(Newton)*

- T_2 Tension in Slack Side of Belt *(Newton)*
- W Load Applied *(Newton)*
- W_{dead} Dead Load *(Newton)*
- W_{end} Weight at Outer End of Lever *(Newton)*
- θ Angle of Twist *(Radian)*

Constants, Functions, Measurements used

- Constant: **pi**, 3.14159265358979323846264338327950288
  Archimedes' constant
- Measurement: **Length** in Meter (m)
  Length Unit Conversion
- Measurement: **Pressure** in Newton per Square Meter (N/m²)
  Pressure Unit Conversion
- Measurement: **Power** in Watt (W)
  Power Unit Conversion
- Measurement: **Force** in Newton (N)
  Force Unit Conversion
- Measurement: **Angle** in Radian (rad)
  Angle Unit Conversion
- Measurement: **Torque** in Newton Meter (N*m)
  Torque Unit Conversion
- Measurement: **Second Moment of Area** in Meter⁴ (m⁴)
  Second Moment of Area Unit Conversion

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