INVESTICE DO ROZVOJE VZDĚLÁVÁNÍ

Název projektu**: Automatizace výrobních procesů ve strojírenství a řemeslech**
Registrační číslo: **CZ.1.07/1.1.30/01.0038**
Příjemce: **SPŠ strojnická a SOŠ profesora Švejcara Plzeň, Klatovská 109**
Tento projekt je spolufinancován Evropskou unií a státním rozpočtem České republiky

Produkt:

Zavádění cizojazyčné terminologie do výuky odborných předmětů a do laboratorních cvičení

DYNAMICS - Power, input power, efficiency

Návod v anglickém jazyce

Číslo tématu: **4b**

Monitorovací indikátor: **06.43.10**

INSTRUCTIONS FOR TOPIC: 4b

Created in school year: 2012/2013

Branch: 26-41-M/01 Electrical Engineering - Mechatronics

Subject: Mechanics

Year: 2.

Prepared by: Ing. Josef Gruber; translated by: Bc. Veronika Mádlová

DYNAMICS - Power, input power, efficiency

Type of lesson**:** Theoretical lesson

Teaching aids: Textbook and workbook (Gruber, J. *Dynamika*.)

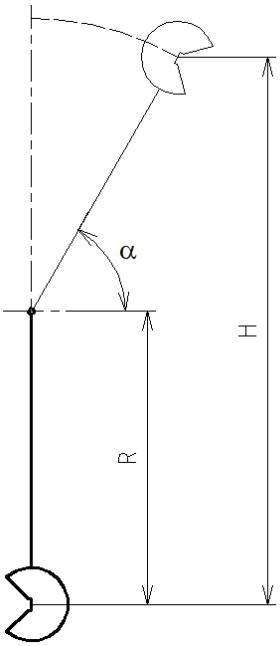
Lesson objective: Pupil defines power, states units, calculates force power and torque, expresses efficiency.

Educational objective: Methodical solution of a problem, task analysis.

Lesson stages

1. Revision of the previous lesson

- Express principle of conservation of momentum; How does it show in a propulsion of the plane with the jet engine?
- How do you calculate work of the inclined force? Specify the statement “inclined plane saves work”.
- Express principle of conservation of mechanical energy.
- An exercise from the workbook



Defined: Charpy testing machine (Charpy hammer) for the Charpy impact test, Maximal energy of the machine is E = 300 J, radius of the rotation R = 1 m and the angle in the starting position is 60°.

Calculate: Charpy hammer mass m and the velocity in the lower position before a contact with specimen. Solve the hammer as a particle on the intangible rod.

2. Motivation

Motivational discussion about parameters of products with putting emphasis on power, consuption, efficiency. Use of knowledge of these terms from the previous education.

3. Explication of the new curriculum

a) Definition and calculation of power and moment.

- Power („work efect “) is performed work in time unit. State a basic relation for power and units.
- Power of force and torque. Point out the analogy between linear and rotational motion.

b) Efficiency

- Principle of conservation of energy, real nature so called energy losses.
- Efficiency and possibilities of its expression.
- The total efficiency of the device (serial sorting of mechanical systems), multiplication of partial efficiency.

4. Notes in the exercise book

- Highlight the basic knowledge, i.e. term definition and basic calculated relation. Do not substitute the textbook.

5. Exercises

- Exercise from the textbook (solved, pupils try solving it themselves, they use the textbook in case of difficulties).

Defined: A crane is lifting a burden m = 5 t in 20 s to the height of 5 m.

Calculate: input power of electric engine in kW, if the total efficiency is 70 %.

Solution:

Required power for even lifting of the burden:

$$P_2 = G \cdot v = mg \cdot \frac{h}{t} = 5000 \cdot 9{,}81 \cdot \frac{5}{20} = 12\,265{,}5\ (\mathrm{W})$$

Input power

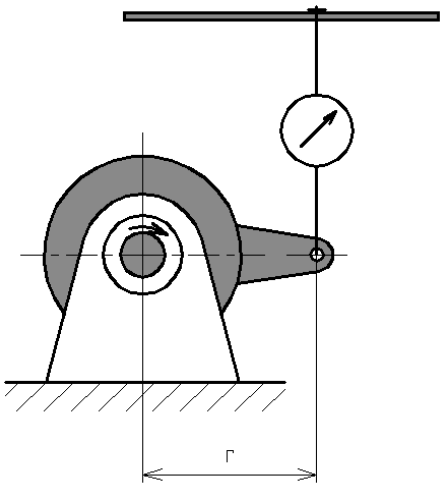
$$P_1 = \frac{P_2}{\eta} = \frac{12\ 256{,}5}{0{,}7} = 17\ 509{,}29\ (\mathrm{W}) = \underline{17{,}5\ (\mathrm{kW})}$$

- Exercise from the workbook:

Defined: Power of diesel engine is measured by breaking. The arm of the break has lenght

r = 0,6 m is connected to a measuring device that shows force F = 500 N. Engine speed is n = 1800 min^{-1} in precise moment.

Calculate: power of the engine.



6. Homework assignment

- Exercise from the workbook:

Defined: The machine drive is realized by engine and gearbox. Torque of the engine is M_{KM} = 1000 Nm, speed of the engine n_M = 1500 min^{-1}. The efficiency of the engine is 98%, the gearbox efficiency is 96 % and the efficiency of the machine is 94 %.

Calculate: required input power and power of the work machine.

7. Conclusion

- Evaluation of the lesson and activity of pupils in solving problems.

Zdroj:

GRUBER, J., *Mechanika IV- Dynamika*. SPŠS a SOŠ prof. Švejcara, Plzeň. Dostupné z www: http://www.spstr.pilsedu.cz/osobnistranky/josef_gruber/mec_new.html

DYNAMIKA - Výkon, příkon a účinnost - DYNAMICS - Power, input power, efficiency - slovníček odborných termínů

Vocabulary	Slovníček
dynamika	dynamics
energie	energy
energie kinetická	kinetic energy
energie potenciální	potential energy
hmotnost	mass
hmotnost hmotného bodu	mass of a particle
hmotnost tuhého tělesa	mass of a rigid body
hmotný bod	particle
hybnost	momentum
krouticí moment	torque
mechanická práce	work
motor	engine
ohyb	bending
pohyb	motion
samosvorný	self-locking
síla	force
síla setrvačná	inertia force
silové pole	field of force
silové pole potenciální	conservative field of force
tření	friction
tuhé těleso	rigid body
účinnost	efficiency
účinnost mechanická	mechanical efficiency
výkon	power
výkon síly	power of a force
výkon užitečný	effective power
výkon vstupní (příkon)	input power
zákon zachování hybnosti	principle of conservation of momentum
zákon zachování mech. energie	principle of conservation of mechanical energy