Mansoura University

Faculty of Engineering
Dept. of production & Mechanical Design

Final Exam June 2010
Date: 26-6-2010
Time: 3 hours
Full mark: (70 mark)

Exam of Theory of machines (2)
For Mechanical Engineering Dept. Grad 2 students

Question One:

Derive the equation of motion for the following system shown in Fig. 1 by using Newton Method, then determine the natural frequency. Also find the equivalent mass and stiffness of the system.

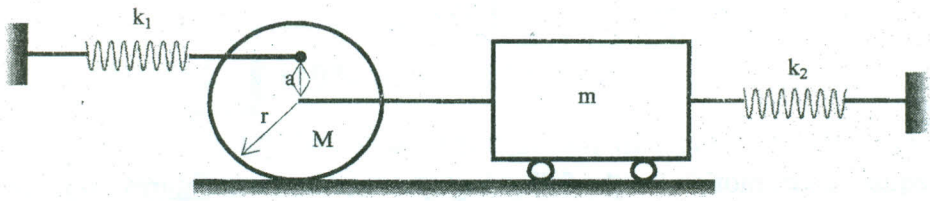

Fig. 1

Question Two:

A mass of 50 kg is attached to the free end of a vertical spring, which is fixed at the other end, causes a static deflection of 1.635 cm. When the support is given a simple harmonic motion of circular frequency equal to 20 radians per second, the vibration amplitude is found to be 15 cm when damping is negligible. But when damping varies, the amplitude is found to be 7.5 cm. Determine:

a) The damping coefficient.
b) The logarithmic decrement.
c) The periodic time of the damped vibration.
d) The phase angle when damping is in operation.
e) The magnification factor when damping is in operation.

Question Three:

Fig. 2 shows an I.C. engine driving rotating machinery. The pinion is directly coupled to the engine. The mass moment of inertia of the engine is 0.8 kgm^2 and that for the pinion and gear, 0.0015 kgm^2 and 0.117 kgm^2 respectively. The inertia of the rotating machinery and flywheel are 15 and 30 kgm^2 respectively. Modulus of rigidity for steel shafts is 84 GPa. The speed reduction from engine to rotating machinery is 3:1. Determine the one and two natural frequencies and amplitude ratios.

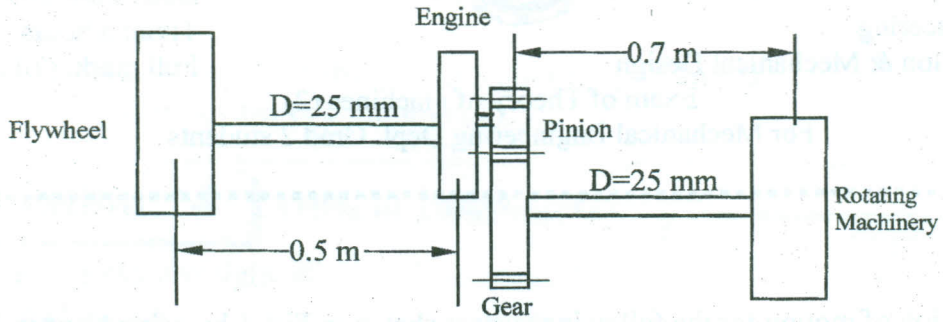

Fig. 2

Question Four:

Write only the equations of motion for the following systems shown in figures (3-a) and (3-b).

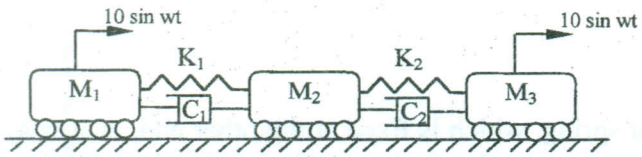

Fig. 3-a

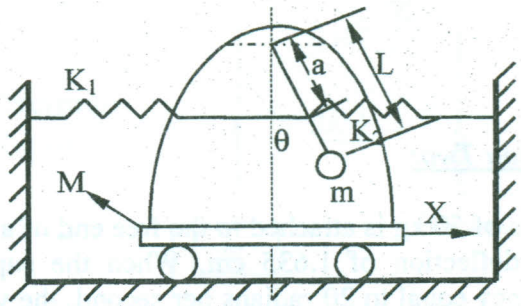

Fig. 3- b

Best Wishes
Dr. Noha Fouda