RULES

1. The answers of the exercises will be posted on our website at 17:00 PM on 03.01.2013: www2.ce.metu.edu.tr/~ce305 .
2. This is the **version 6.0**. In case there are any corrections for this exercise, we will post an updated version on our website. You can follow the changes in the exercises by the **Version History** section below.

Version History

V6.0 Exercise is released.

1. Compute $\int_{0.5}^{1.5} e^x \cos x \, dx$ using Gaussian quadrature with:

a) 2 points by hand computation.

b) 2 points by MATLAB.

c) 3 points by MATLAB.

d) The exact value of the integration is 1.27508. Find the true error for both 2 points and 3 points cases.

Use 5 decimal places in your calculations.

2. Find the first derivative of f(x) at x=0.2, 0.4, 0.5 where f(x) is given by:

x	0.1	0.2	0.3	0.4	0.5	0.6
f(x)	0.425	0.475	0.400	0.450	0.525	0.675

Use Central Difference Formula.

3. A body with a concentrated mass subjected to vibration can be modeled as a dynamic single degree of freedom (SDOF) oscillator system as shown in the figure below. In this setting, k represents the stiffness of the system. The spring force is proportional to the deflection as k*u(t). P(t) represents any dynamic force acting on the system. *(Physical examples for this setting can be a structure with concentrated mass at the top or a seismometer device which is used to measure the ground motion.)*

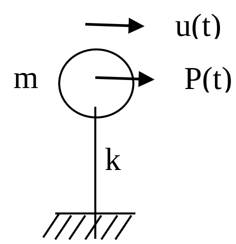
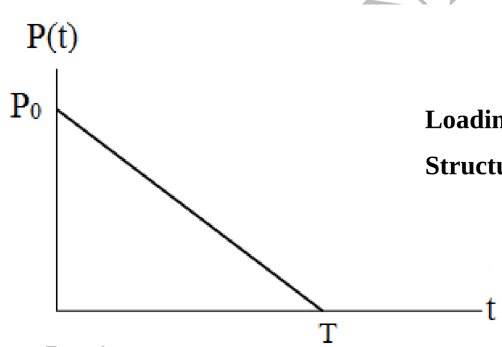


Figure 1

From Newton's second law, the equation of motion for the mass is: $m\ddot{u}+ku=P(t)$ with boundary conditions u(0)=0 and u'(0)=0.

Now assume a water tank is modeled as a SDOF oscillator. An explosive force P(t) is given below and we would like to test the structure under this possible explosion.



Loading: P_0=500 kN, T=0.5 sec

Structural Properties: k= 10000 kN/m, mg=100 kN

a) Express the second-order differential equation of motion as a system of first-order differential equations

b) Use h=Δt=0.125 sec with Euler's method to find the spring force at 0.5 sec (Manual calculations)

c) Now repeat part (b) using MatLAB with h=0.05 sec,

i. with Euler's method

ii. with Heun's method (non-iterative version)

d) Compare your results and comment briefly.