คณะวิศวกรรมศาสตร์

มหาวิทยาลัยสงขลานครินทร์

การสอบกลางภาค ประจำภาคการศึกษาที่ 2 ประจำปีการศึกษา 2552

วันที่ 22 ธันวาคม 2552 เวลา 09.00-12.00 น.

วิชา 215-612 Finite Element Method ห้อง S203

<u>คำสั่ง</u>

1. ข้อสอบมีทั้งหมด 4 ข้อ ๆ ละ 25 คะแนน ให้ทำทุกข้อ
2. อนุญาตให้นำเอกสารทุกชนิดเข้าห้องสอบได้

ผศ.ดร.เจริญยุทธ เดชวายุกุล

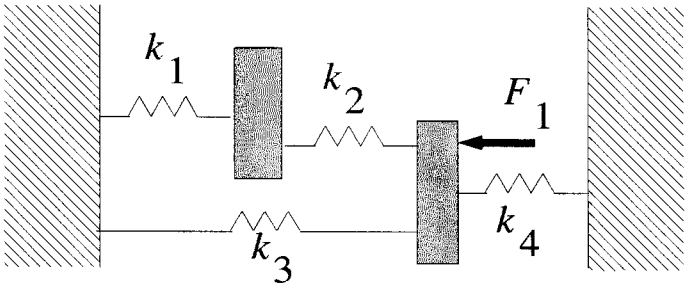
ผู้ออกข้อสอบ

ชื่อ-สกุล.....รหัส..... ตอน.....

Name_____Last Name_____Student ID._____

1. Four rigid bodied are connected by four springs as shown in the figure. A horizontal force of 1,000 N is applied as shown. Using finite element method, (a) find the displacements of each body if both ends are constrained (b) the reaction force at both ends . Assume all bodies can undergo only translation in horizontal direction. The spring constants (N/mm) are

$k_1=400, k_2=500, k_3=500$ and $k_4=300$.



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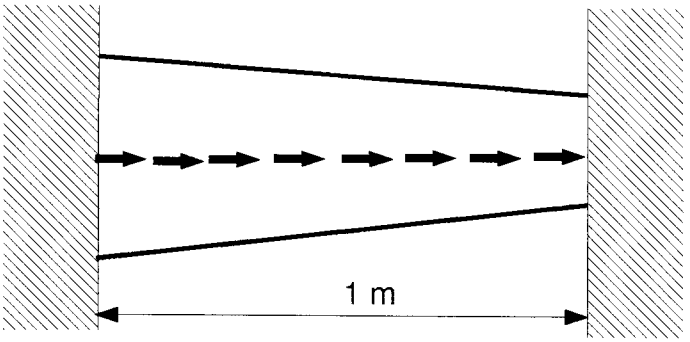
2. Consider a tapered bar of circular cross section. The length of the bar is 1 m, and the radius varies as $r_x = 0.05 - 0.04x$, where r and x are in meters. Assume Young's modulus=100 MPa. Both ends of the bar are fixed and a uniformly distributed load of 10,000 N/m is applied along the entire length of the bar. Determine the displacements, axial force and the wall reactions using 3 elements of equal length



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3. Consider the following differential equation:

$$\frac{d^2u}{dx^2}+u+x=0, \quad 0<x<1 \quad \text{if} \quad u(0)=0, \quad u'(1)=1$$

The solution is approximated as $\tilde{u}(x)=c_1x+c_2x^2$

Use the Galerkin method to solve the coefficients of approximated solution. Compare with the exact solution: $u(x)=3.7\sin(x)-x$

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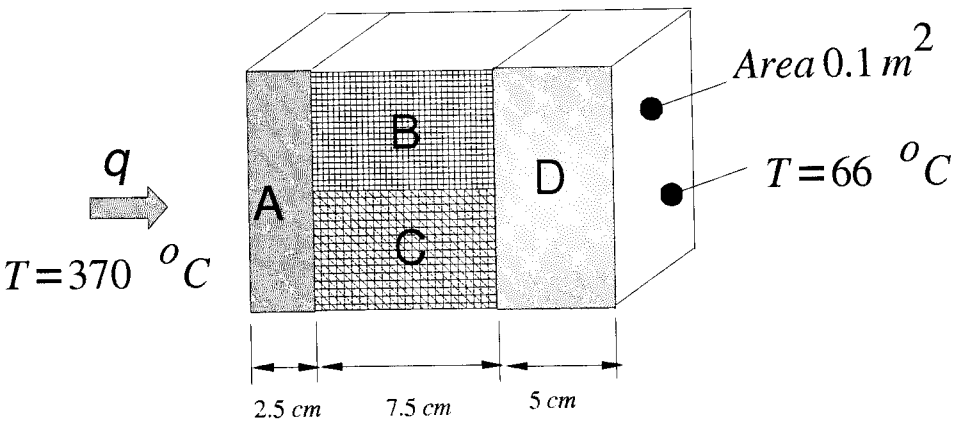
4. Find the heat transfer per unit area through the composite wall as shown. Assume one-dimension heat flow and there is no heat flow between B and C. The thermal conductivities are

$k_A = 0.04\ W/m/^oC$ $k_B = 0.1\ W/m/^oC$ $k_C = 0.03\ W/m/^oC$, and

$k_D = 0.06\ W/m/^oC$



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