UNIVERSITY OF TORONTO
DEPARTMENT OF CIVIL ENGINEERING

CIV210S MECHANICS OF SOLIDS

Final Examination
December 19, 2001

Examiner: Professor S.A. Sheikh

Last Name: **Initials**

Student Number:

Read the following instructions carefully

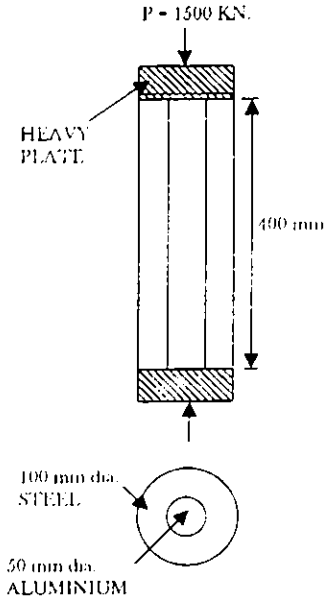
1. Write your name on all sheets.
2. Use back of the sheets if necessary.
3. If needed, number the pages to indicate the sequence of your solution.
4. Marks for each question are shown in parenthesis.
5. You can use one standard aid sheet.

Question	Marks
1	/20
2	/20
3	/20
4	/25
5	/15
Total	/100

Name: _____

1. The cylindrical member shown in the figure below is made from steel and aluminum. The yield strengths of steel and aluminum are 300 MPa and 250 MPa, respectively. The modulus of elasticity can be taken as 200,000 MPa for steel and 70,000 MPa for aluminum. Calculate the stress in each of the two materials under the load P. Determine also the strain and strain energy density in both the materials.

(20)



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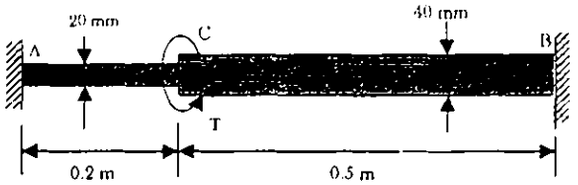
2. A stepped shaft of solid circular cross sections (see figure) is fixed against rotation at the ends. If the allowable stress in shear is 70 MPa, what is the allowable torque T that may be applied to the shaft at point C? (Hint: Section properties of the shaft between A and C are different than the section properties between B and C).

(20)



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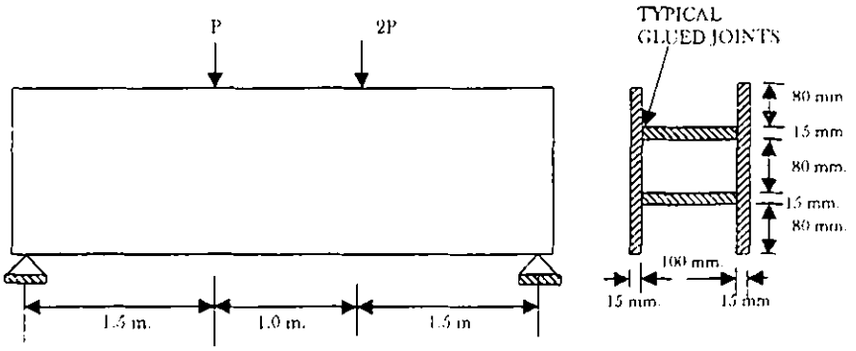
3. The beam shown below is constructed from four boards glued together at their seams. If the glue can withstand 1.5 N/mm of shear, what is the maximum load P that the beam can support.

(20)



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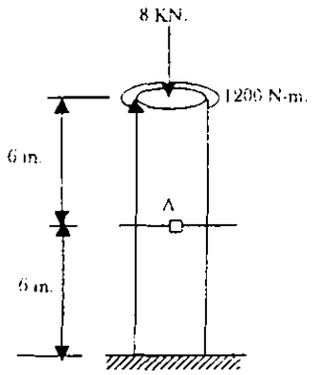
4. The drill pipe shown below has an outer diameter of 80 mm, a wall thickness of 6 mm and weighs 730 N/m. If it is subjected to an axial load and a torque as shown, determine (a) the principal stresses and (b) the maximum in-plane shear stress at a point A on its surface 6 meters from the top.

(25)



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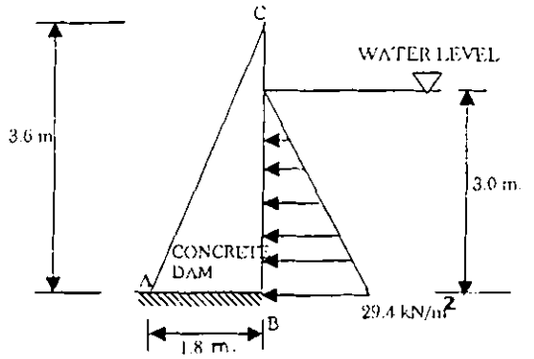
5. A small dam of triangular shape is made from concrete which weights 23.54 kN/m³. The water level is at 3.0 m height as shown in the figure. The water pressure considering 1 m length of the dam perpendicular to the plane of the paper is also given in the figure. Find the normal stress distribution at section AB. Is the dam safe if it is not anchored into the ground?

(15)



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